

COMPUTING FOR BUSINESS AND HOME

INTERFACE AGETM

APRIL 1981

\$2.50/CANADA/MEXICO \$3.00

THE MICRO CONTROLLED HOME

COMPARING PERSONAL SYSTEMS

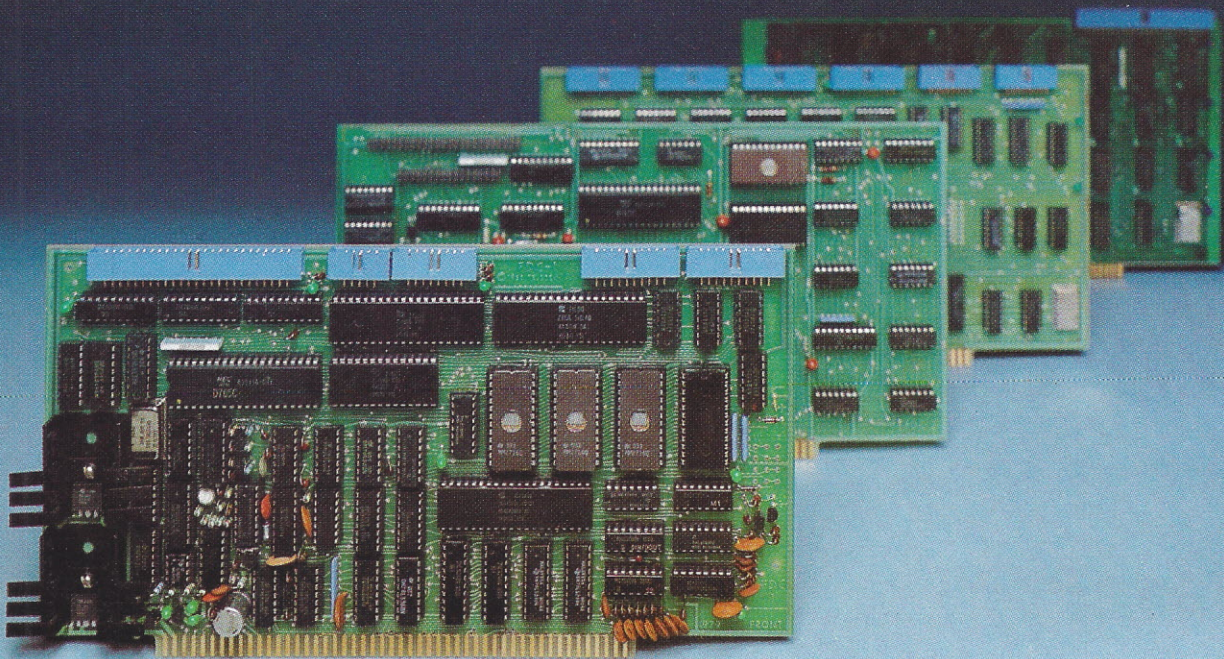


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PERFORMANCE



TELETEK's family of high-technology IEEE-S100 boards offers the highest performance to cost ratio in the industry. They're powerful, useable, and they fit—together and in your system.

FDC-I: Still the most powerful IEEE-S100 board on the market. Z80A CPU, single- or double-density floppy-disk controller, two serial and two parallel ports, 8k of memory, timer, a 2716 burner, etc., all on one board! Based around the powerful Z80A family and the exceptional NEC765 (or Intel 8272) controller chip, this unit is a microcomputer on one board! CP/M®, MP/M®, Oasis®, Infsoft® compatible.

PSIO: A two-parallel, four serial port board designed around the Z80A family, using its powerful vectored interrupt structure. The board is designed for use in multi-user systems and is currently running with the FDC-I and MP/M®. As many as 14 PSIOs may be daisy-chained in one system under interrupt control.

FDC-II: A powerful single- or double-density FDC capable of controlling as many as eight drives simultaneously. The FDC-II has an on-board data buffer which allows operation independent of the CPU—no particular CPU speed nor continuous CPU overhead are required when transferring data to or from the floppy disk drive.

I²: Teletek's Intelligent Interface is capable of simultaneously interfacing several parallel devices, including intelligent hard disks, to the S-100 bus. Its own on-board Z80A CPU (optionally Z80B, 6MHz) runs independently of the system CPU and takes no system memory space. On-board buffer space, DMA I/O transfer, more.

What else do we offer? How about the strongest support in the industry (check our documentation—it's been called the best anywhere). We're dedicated to getting your system up and running properly.

But isn't that what you'd expect from a company that's been around for twelve years?

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Cromemco accepts your challenge, Data General

Yes, Data General, we saw your ad.

So we realize you hope to win over some of our computer business.

And we can see you have reason to be pleased about your line of minicomputers. They are MINIs though.

But Cromemco produces state-of-the-art MICROcomputers.

Powerful ones.

And our micros have some outstanding advantages.

For example, Cromemco is the only microcomputer manufacturer to support a broad range of microcomputers with (a) 5-inch

double-sided, double-density floppy disk drives and with (b) 8-inch double-sided, double-density floppy disk drives AS WELL AS (c) 8-inch Winchester hard disk drives.

That means, of course, that our customers have a wide choice of disk storage capability.

UNEQUALLED SOFTWARE SUPPORT

OK. That was one point.

Here's another: our stunning selection of software support. Cromemco is the only micro manufacturer to produce both single-user and multi-user multi-tasking computers with software like this:

SYSTEM SOFTWARE

- CDOS (a CP/M-like operating system)
- CROMIX (a UNIX-like operating system)
- RPG-II (IBM-compatible)
- COBOL
- BASIC
- FORTRAN IV
- RATFOR
- LISP
- C
- Macro Assembler

APPLICATION SOFTWARE

- Word Processing System
- Data-Base Management
- General Ledger
- Accounts Receivable
- Accounts Payable
- Inventory

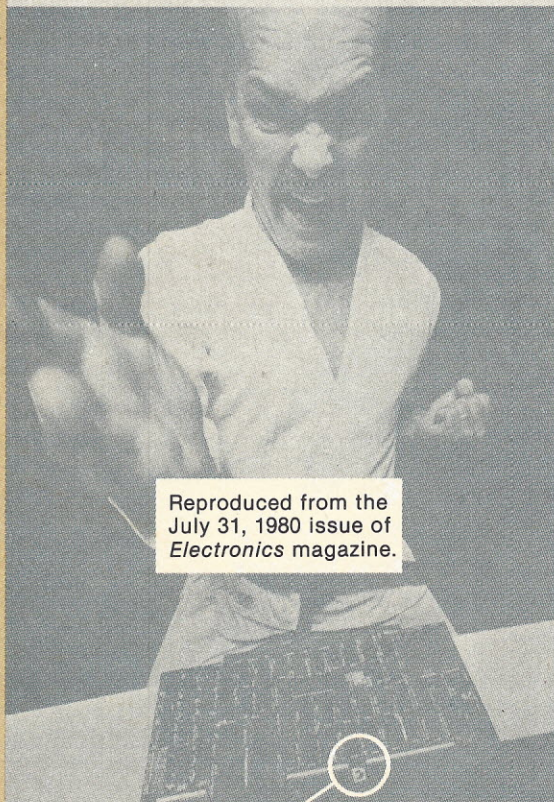
All of this is available now with more coming all the time.

So there you are, D.G.

You can see why we know our microcomputers will stand the test.

Cromemco eagerly accepts the challenge.

WE'RE BUSTING THE COMPETITION'S BOARDS AGAIN.



Reproduced from the July 31, 1980 issue of *Electronics* magazine.

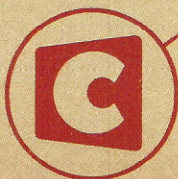
Announcing MBC/2 and MBC/3, the newest members of Data General's growing family of microNOVA™ board computers. They're the best computers on a board money can buy. You get up to 64K bytes of memory, serial and parallel I/O lines, and software support from MP/OS, our famous micro operating system. You even get supporting languages like MP/PASCAL and MP/FORTRAN IV. See for yourself.

	MBC/2	MBC/3	LSI 11/2	SBC/ 86/12
RAM Bytes	32K	64K	32K	32K
ROM EPROM Bytes	4K	32K	32K	16K
Serial Lines	1	2	2	1
		ASYNCH/ SYNC	ASYNCH/ SYNC	
Dig I/O Lines	32	32	32	24
# Boards	1	1	1	1
Board Size	7.5x9.5	7.5x9.5	8.5x3.2	6.75x12

The competition will always sing the praises of their little single board computers. But from now on they'll be doing it falsetto.

Data General Corporation, Westboro, MA 01580, (617) 366-8911. microNOVA is a trademark of Data General. ©Data General Corporation, 1980.

Data General
Mail to: Data General Corporation, Westboro, MA 01580
Don't read buried boards. Send complete information
on the "MBC" product line. CI 11/80, and a salesman ASAP.
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Cromemco logo on computer board shown in original ad



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Cover photo of Sun-tronics home, Stamford, CT, courtesy of Copper Development Assoc., New York, NY.

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Contact authors of monthly columns by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701 in care of their respective columns.

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SuperSoft's Gallery of CP/M Masterworks

SUPER-M-LIST: A complete, easy to use mailing list program package. Allows for two names, two addresses, city, state, zip and a three digit code field for added flexibility. Super-M-List can sort on any field and produce mailing labels direct to printer or disk file for later printing or use by other programs. Super-M-List is the perfect companion to TFS. Handles 1981 Zip Codes!

Requires: 48K CP/M

Supplied with complete user manual: \$75.00 manual alone: \$10.00

TFS-Text Formatting System: An extremely powerful formatter. More than 50 commands. Supports all major features including:

- left & right margin justification
 - user defined macros
 - dynamic insertion from disk file
 - underlining and backspace
- TFS lets you make multiple copies of any text. For example: Personalized form letters complete with name, address & other insertions from a disk file. Text is not limited to the size of RAM making TFS perfect for reports or any big job. Text is entered using CP/M standard editor or most any CP/M compatible editor.

Requires: 24K CP/M

Supplied with extensive user manual: \$85.00 manual alone: \$20.00

Source to TFS in 8080 assembler (can be assembled using standard CP/M assembler) plus user manual: \$250.00.

TEXT PROCESSING

DIAGNOSTICS I: Easily the most comprehensive set of CP/M compatible system check-out programs ever assembled.

Tests:

- Memory
 - CPU (8080/8085/Z80)
 - Terminal
 - Disk
 - Printer
- To our knowledge the CPU test is the first of its kind anywhere. Diagnostics I can help you find problems before they become serious. A good set of diagnostic routines are a must in any program library. Minimal requirements: 32K CP/M. Supplied with complete user manual: \$75.00 Manual alone: \$15.00

DIAGNOSTICS II: Includes all of Diagnostics I, plus:

- Every test is "submit"-able
- A complete Spinwriter/Diablo/Qume test has been added (Serial Interface only)
- Output may be logged to disk
- Expanded memory test
- Expanded terminal test
- Expanded disk test

Diagnostics II provides the next level in system maintenance.

Requires: 32K CP/M

Price: \$100.00 Manual only: \$15.00

SYSTEM MAINTENANCE

UTILITIES I: A collection of programs that you will find useful and maybe even necessary in your daily work (we did!).

Includes:

- GREP: Searches files for a specified string
- SORT: In core sort of variable length records
- CMP: Compare two files for equality
- PRINT: Formatted listings to printer
- PG: Lists files to CRT a page at a time

... plus more ...

Requires: 24K CP/M

Supplied with manual on discette: \$60.00

UTILITIES II: Many new programs not available elsewhere. Includes these "file" utilities:

- DIFF: Source comparator
- PR: Powerful multicolumn output formatter
- CAT: Concatenate files
- RPL: Substitute strings in files

... plus more ...

Requires: 24K CP/M \$60.00

Supplied with manual on discette

UTILITIES

ANALIZA: An amazingly accurate simulation of a session with a psychiatrist. Better than the famous "ELIZA" program. Enlightening as well as fun. An excellent example of Artificial Intelligence.

Requires: 48K CP/M, CBASIC2
Cost: \$35.00

ENTERTAINMENT

Z8000CROSSASSEMBLER: Supports: full Z8000 syntax, segmented and unsegmented mode, full 32-bit arithmetic, hex output, listing output, "downloader".

Requires: 56K CP/M \$500.00
1 year maintenance \$300.00
manual alone \$ 50.00

Z8000 too!

'TINY' PASCAL II: We still call it 'Tiny' but it's bigger and better than ever! This is the famous Chung-Yuen 'Tiny' Pascal with more features added. Features include:

- recursive procedures/functions
- integer arithmetic
- CASE
- FOR (loop)
- sequential disk I/O
- 1 dimensional arrays
- IF...THEN...ELSE
- WHILE
- PEAK & POKE
- READ & WRITE
- REPEAT...UNTIL
- more

'Tiny' Pascal is fast. Programs execute up to ten times faster than similar BASIC programs. SOURCE TOO! We still distribute source, in 'Tiny' Pascal, on each discette sold. You can even recompile the compiler, add features or just gain insight into compiler construction.

Requires: 36K CP/M. Supplied with complete user manual and source on discette: \$85.00. Manual alone: \$10.00

STACKWORK'S FORTH: A full, extended Forth interpreter/compiler produces COMPACT, ROMABLE code. As fast as compiled FORTRAN, as easy to use as interactive BASIC.

SELF COMPILING: Includes every line of source code necessary to recompile itself.

EXTENSIBLE: Add functions at will.

Z80 or 8080 ASSEMBLER included.

Single license, OEM licensing available.

Please specify CPU type: Z80 or 8080

Supplied with extensive user manual and tutorial: \$175.00

Documentation alone: \$25.00

SSS FORTRAN: The SSS FORTRAN compiler is fast, efficient, and complete (full 1966 ANSI standard with extensions). The RATFOR compiler compiles into FORTRAN allowing the user to write structured code while retaining the benefits of FORTRAN. The FORTRAN supports many advanced features not found in less complete implementations, including: complex arithmetic, character variables, and functions. Complete sequential and random disk I/O are supported. SSS FORTRAN will compile up to 600 lines per minute! Recursive subroutines with static variables are supported. ROMable ".COM" files may be generated. SSS RATFOR allows the use of contemporary loop control and structured programming techniques. SSS RATFOR is similar to FORTRAN '77 in that it supports such things as:

- REPEAT...UNTIL
- WHILE
- IF...THEN...ELSE

SSS RATFOR is supplied with source code in FORTRAN and RATFOR.

System Requirements & Prices:

SSS FORTRAN requires a 32K CP/M system.

SSS FORTRAN with RATFOR: \$325.00

SS FORTRAN alone: \$250.00

RATFOR alone: \$100.00

(Sold only with valid SSS FORTRAN license)

PROGRAMMING LANGUAGES

TERM: A complete intercommunications package for linking your computer to other computers. Link either to other CP/M computers or to large timesharing systems. TERM is comparable to other systems but costs less, delivers more and source is provided on discette! With TERM you can send and receive ASCII and Hex files (COM too, with included conversion program) with any other real time communication between users on separate systems as well as acting as timesharing terminal.

- Engage/disengage printer
- error checking and auto retry
- terminal mode for timesharing between systems
- conversational mode
- send files
- receive files

Requires: 32K CP/M

Supplied with user manual and 8080 source code: \$150.00

Manual alone: \$15.00

INTERCOMPUTER COMMUNICATIONS

ENCODE/DECODE: A complete software security system for CP/M. Encode/Decode is a sophisticated coding program package which transforms data stored on disk into coded text which is completely unrecognizable. Encode/Decode supports multiple security levels and passwords. A user defined combination (One billion possible) is used to code and decode a file. Uses are unlimited. Below are a few examples:

- data bases
- payroll files
- programs
- tax records

Encode/Decode is available in two versions:

Encode/Decode I provides a level of security suitable for normal use.

Encode/Decode II provides enhanced security for the most demanding needs.

Encode/Decode I: \$50.00 Encode/Decode II: \$100.00 manual alone: \$15.00

SOFTWARE SECURITY

CP/M Formats: 8" soft sectored, 5" Northstar, 5" Micropolis Mod II, Vector MZ, Superbrain DD/QD

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FMS-80, a data base management system, is the most powerful DBM program available to the microcomputer industry. Written in assembly language, it offers these features:

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 - User Definable: Screen formatting with up to 255 screens per data file, report generator, and menus capable of calling other CP/M programs or FMS-80 programs.
 - No restrictions to record size other than available RAM memory size.
 - Instantaneous data record inquiry on indexed data records.
 - Capable of selecting on any field or multiple fields with multiple selection criteria (fields do not have to be keyed).
 - Mathematical manipulation of numeric data fields (add, subtract, multiply and divide).
 - Capable of collecting information from multiple data files and generating a new data file or report.
 - All menu driven.
 - Capable of abstracting data from other programs written in other languages.
 - Available now (off the shelf).
- All these capabilities are available with the added plus of ease of programming.

See What Users of FMS-80 Have to Say:

Mike Ketcham, systems consultant and programmer for Management Information Systems: "FMS-80

allows me the flexibility of quickly creating programs for user applications. It is flexible, in that data can be entered in a form that the secretary recognizes and generates reports that the manager requires. Also, the user-definable menus allow me to actually generate a menu from which the user can select, creating a true turnkey system." Tom Niccoli, Partner, Computerland of Phoenix: "FMS-80 is flexible enough to acquire data from an application program that was previously written and allowed me to generate the reports that my customer needed. It closed the deal for me. Considering its capability, FMS-80 is one of the most cost-effective application programs available today."

If you're continuously asked to do applications programming, and you don't have the time to do it in Basic, consider FMS-80. For additional information on FMS-80, contact
**Systems Plus, 1921
3975 East Bayshore,
Palo Alto,
CA 94303
Phone (415) 969-7047.**



Mike Ketcham, Management Information Systems, Belmont, CA



Systems Plus

*TM of Digital Research, Pacific Grove, CA
**TM of Cromemco, Sunnyvale, CA

EDITOR'S NOTEBOOK

The perfect 24-hr secretary...who really means business

It seems that no activity is too lowly that it cannot be micro-ized into an enterprise of such enormous scope and potential that it would dumbfound its originators. One that is undergoing such treatment is the humble telephone answering service.

What, one can reasonably ask, is so dumbfounding about answering a phone and taking a message? Plenty...if your plans are to turn this simple reflexive function in to a round-the-clock "secretary" who will never be late, sick or bored...and works efficiently, automatically and almost totally mechanically.

That's precisely what George Smith, president of Answer Network in Costa Mesa, CA, envisions: "Our concept... let's take the ordinary plumber. Our service can take his repair calls and schedule them with the computer. When he calls in, we tell him where his next job is.

"He finishes it, calls back and says, 'I'm through.' We have his work time and the customer's name and address. We can make out the bill and mail it the next day. He'll tell us the parts he used and they will be put on inventory order, to be filled at the end of the week.

"When we receive payment for the job, it will be deposited to his account and at the end of the week he gets a statement of what he did, what his inventory (costs) is and how much money he made. If he has a pager, we can get emergency calls to him.

"All he does is plumbing. That's the way he makes his \$20 an hour. He has no reason whatever to set up an office or carry paperwork home. Handling his own bookwork—and fighting it—doesn't earn him one cent."

When you project Smith's concept only against the nation's plumbers, then against all the other small businessmen who operate similarly, you grasp that the "enormous potential" is genuinely "dumbfounding." And it doesn't stop there.

Middle and even large businesses are targeted in the scheme. As Smith sees it: "What we want to do is take over their PBXs at 5:00. If there is a service call, locate the serviceman and get him on his way. If a sales call, either take it or refer it to a salesman on call. If it's a call for the president of the company, screen it and, if it's important, relay it to him that night."

Smith's automated system is the first workable one in the field. Exxon re-

Continued on page 160



Clustered in a cramped line, the typical answering service operator has to watch the switchboard and count light blinks before answering. She may have as many as 80 clients for whom she simultaneously must answer the phone, write messages, time stamp them, answer questions, file master cards and relay messages.



At a comfortable airy terminal, the computer takes over the ring counting and other trivial tasks, freeing the operator to take messages calmly, accurately and professionally while entering them into a data base. Callers seldom realize they are talking with an answering service. Cost for a six-terminal unit is \$120,000.

Meet the HP Series 80: Hewlett-Packard's new one-on-one computing systems for professionals.



Together, You can Analyze Technical Problems and Evaluate Solutions. Rapidly and Accurately.

HP Series 80 personal computing systems provide the technical solutions you require. Quickly! Easily! Inexpensively! Analysis techniques that were formerly difficult and often impossible, become part of your everyday work routine. You can evaluate functional behavior, select variable alternatives, perform cost analysis...and more...all with greater accuracy and using more variables than you thought possible.

Series 80, VisiCalc™ PLUS And You

HP's VisiCalc™ PLUS is a major new software tool. It's an electronic worksheet that instantly recalculates results as you change the variables. You ask the *what-if* questions and immediately see their effects on your solution. No programming is necessary...you can become proficient with VisiCalc™ PLUS in a few hours...and then watch your horizons broaden. VisiCalc™ PLUS features many powerful functions including statistical analysis tools and the entire HP Series 80 BASIC math set. Plus graphics! Create professional presentations with curve-fitting plots, stacked or clustered bar-graphs, exploded pie-charts and line graphs, all in up to four colors, on paper or transparencies.

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HP Series 80 personal computing systems are part of a forty-year tradition of electronic products built to uncompromising standards of excellence. Additionally, HP Series 80 products are serviced by HP technicians and on-site service contracts are now available. We urge you to judge for yourself with a hands-on, one-on-one demonstration at your HP dealer. For locations, call TOLL-FREE 800-547-3400, Dept. 284A, except Alaska/Hawaii. In Oregon call 758-1010. Or write Hewlett-Packard, Corvallis, Oregon 97330, Dept. 284A.

611/04

CIRCLE INQUIRY NO. 32

HP Series 80 Personal Computers for Professionals: HP-85 (\$3250*) and HP-83 (\$2250*) specifications: 16K RAM expands to 32K, 32K ROM expands to 80K; CRT with integrated graphics; (HP-85 only; built-in thermal printer, cassette tape unit); Software includes VisiCalc™ PLUS, Information Management, Graphics Presentations, Surveying, Data Communications (Spring '81), Statistics, Regression Analysis, Math, Linear Programming, Waveform & Circuit Analysis, BASIC Training. HP peripherals include floppy discs, printers and plotters. VisiCalc is a trademark of Personal Software, Inc.

*Suggested retail price excluding applicable state and local taxes—Continental U.S.A., Alaska & Hawaii.



**HEWLETT
PACKARD**

LETTERS

Altered states

Re: Tony Anderson's letter (IA Aug 80) about the article 'Data Base Management for the Apple II' (IA Apr 80), there is a typo that could cause some of your readers considerable trouble.

Line 3355 of Mr. Anderson's addition to the file cabinet program should read:

3355 For I = 1 to RH*3 step 3:

If K (I + 2) = 1 then t9 = 1

not,

3355 For I = 1 to RH etc.

I would be interested in corresponding with anyone attempting useful alterations of the source code for this excellent program.

David J. Deutsch
6447 Bosworth
Chicago, IL 60626

The plot thickens

Thanks to Richard Parry for a most useful article 'Function Plotter' (IA Dec 80), that makes flexible use of an 80-column printer for the plotting of transcendental functions.

Some thoughts on the problem:
(1) For a more 'finished' look, I added:
1130 Print: Print "End of Plot"
1140 END (2) Line 870 should read:
870 IF F1 = 1 OR X<>X4 THEN 1000
(3) Prior to line 810 F1 should be initialized to zero.

Attempting to plot $Y = 1/(x - 1)$ from $X = -5$ to $X = 5$ with increments of 1.5 will not work since the divisor will be zero after four iterations. Increments of 1.3, 1.4 and 1.6 work well.

John E. Heselton
British Columbia, Canada

Survey feedback

I read with considerable interest your excellent survey of micro systems (IA Jan 81). I would, however, like to comment on the statement that "...the world is still waiting for someone to solve the knotty problem of backing up data..."

We have been working on this problem for some time, and have come up with a convenient, economical solution: the Sidewinder family of streaming 1/4-inch cartridge tape drives. We expect these products to not only solve the backup problem, but also to serve as effective I/O devices in conjunction with fixed disk drives.

D. Howard Lewis
Archive Corp.
Costa Mesa, CA

I was surprised by some misleading information in the survey.

Only the H-89 is listed. I have been using the Heathkit H-8 with twin 5 1/4-inch floppy disk drives for years and love it.

How about the H-11 16-bit computer? In the table of memory/storage data, the figure 100K is listed under the floppy disk column. The H-89 will accommodate three 5 1/4-inch floppy disk drives plus two double density, double sided 8-inch drives for over 2 Mbytes of storage. Finally, the table says there is no other applications software. I have disks full of software from the Heath user's group.

Jay H. Gold
Des Moines, IA

The H-8 and H-11 are primarily user-constructed kits, none of which were included in this survey. Disk drive capacities shown are the standard ones, included in the prices listed. Only manufacturer-supplied software is shown, although popular computers like the H-89 are accumulating a substantial amount of user-written software.

Asteroid miners respond

I enjoyed Al Baker's column 'Mining the Asteroids' (IA Dec 80). I hope you will write more such translations for the TRS-80 color computer.

In the two months that I have owned one, I have pursued various magazines for articles and programs written for the 6809E MPU, only to be disappointed. Everything is for the Z-80 or the 6502. In addition, nothing exists even in Basic for the color computer.

I have tried to rewrite some programs written for the model I, level II, but have bogged down in the graphics subroutines or in the 'peek/poke' instructions. It's very frustrating!

I'm interested mostly in simulation gaming, especially of the Dungeons & Dragons variety. I've written a program in Color Basic for the Practice Combat subroutine of the game Melee, a variety of D&D.

I feel very hampered by the lack of instructional material on the 6809E and programming it in assembly language. No books; no cassettes; no assemblers or T-Bugs or anything! Again, very frustrating!

Gordon F. Ross
San Francisco, CA

After reading the column, I couldn't wait to see the game running on my Heathkit H-89. But after hours of frustration, I gave up. It seems like such a simple program, there has to be some way to make it work!

The H-89 does not recognize 'set', 'reset', 'print @', but does allow 'peek' and 'poke'. How do you know where to 'peek' for the arrows? The Heath manuals are very complete, but don't show much about memory mapping.

Steve Shurtleff
Los Alamos, NM

We took your question to the local Heath store. There is a way to read the keyboard if you want to write a machine language routine. However, they strongly recommend that you buy Heath's version of Microsoft Basic. To get detailed information on writing the machine language routine for Benton Harbor Basic, call (616) 982-3200 between 8:30 and 4:30 EST or write Software Assistance, Heath Co., St. Joseph, MI 49085.

Beating the system

I am the president of a small system/software consulting company. One of the problems that occurs repeatedly among my customers is configuring an operating system to a unique combination of disk controller, console and other peripherals. I undertook a survey of the systems available to locate an operating system compatible with Digital Research CP/M and configurable to match the variety of equipment that all business computer users seem to find and install. I decided to try IOS, a product of Infsoft Systems, Westport, CT.

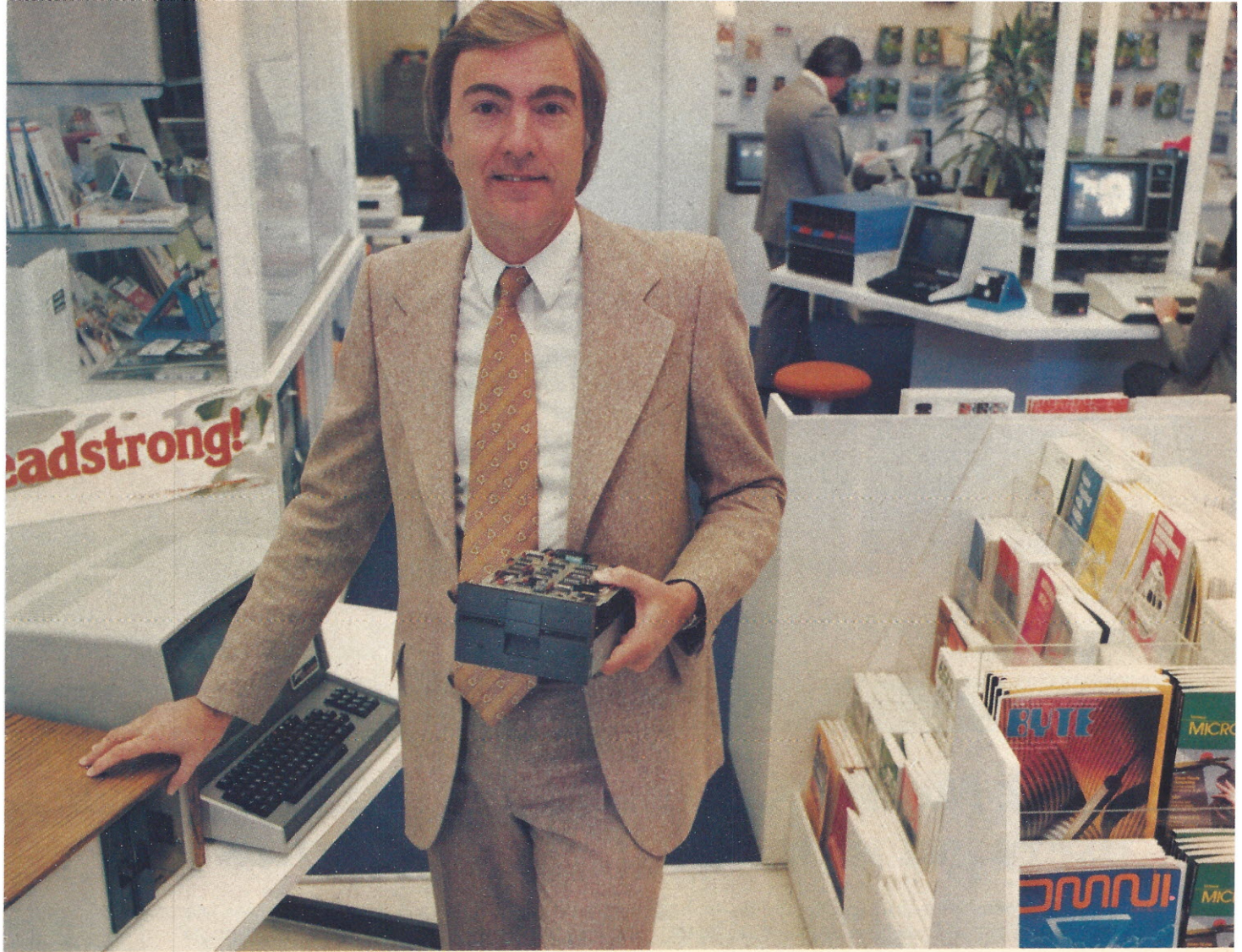
I ordered the configuration pack, containing the IOS programs and an extensive library of driver routines for various disk controllers, terminals, printers and special products. My chance to try an exotic system came with a request from a new marketing firm for a system for their computer and Micropolis disk drives. A quick evaluation of the format showed that my system could not produce a compatible disk. IOS provided a solution—generate an IOS system with both a Cromemco and Micropolis controller, and use that system plus the customer controller and drives to generate and transcribe the customer system. Even though it was necessary to modify the jumper setup on the Micropolis controller, the process worked perfectly and the resulting system operated on the Sol. The CP/M programs ran without change.

I have since encountered a large number of users who are totally unaware that an operating system existed that supported dissimilar disk controllers. With all the reported problems with packaged software for microcomputers, it was refreshing to buy something that did exactly what it was advertised to do.

Thomas L. Nolle
TLN Electronics
Collingswood, NJ

Reader interface

I have a Commodore Pet 2001B (32K) with a 2022 printer and a 2040 dual disk drive. It is most distressing to find so little in your publication pertinent to



“For reliable data storage, you can’t beat Shugart’s Minifloppy.”TM

Raymond Schlitzer, Owner—
Computerland, San Francisco

“I sell systems my customers can depend on. That’s why most of the personal and small business computer systems sold here feature Minifloppy disk drives. I know from experience I can rely on the Minifloppy.”

Since 1976 Shugart’s Minifloppy has been used by more small computer system manufacturers than any other drive. In fact, more than half-a-million Minifloppys

have been installed. The Minifloppy looks small—but it stores a lot of data. 250 kilobytes on one side, or up to 500 kilobytes in the double-sided model. That’s about 50 pages of printed information on a single-sided Minidiskette, and twice that on the double-sided version. You’ll have plenty of storage capacity for your programs, letters, forms, or ledger entries. And you find your data fast, too, because the Minifloppy is a random access device

that eliminates the need to search for your data serially as you must with a tape cassette unit.

No matter what problem you’re solving with your computer system, you can rely on Shugart’s Minifloppy for data storage. We’re known as the Headstrong company for good reason. We’re Headstrong about reliability, quality, and value. Ask your dealer. He knows us.

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Time & Money. Commodore®, Atari® & Apple® users get more with VisiCalc™ software.

A financial VP in Massachusetts is cutting the time it takes to prepare month-end reports from three days to three hours.

A California company is replacing most of its time-share computer service with a personal computer and VisiCalc, saving at least \$30,000 the first year.

Thousands of other personal computer users are also sold on how VisiCalc is increasing their productivity. Besides saving time and money, they're simplifying their work and getting more information that helps them make better decisions. A typical user reaction comes from a New York dentist:

"VisiCalc has become an integral part of my business."

VisiCalc displays an "electronic worksheet" that automatically calculates nearly any number problem in finance, business management, marketing, sales, engineering and other areas. The huge worksheet is like a blank ledger sheet or matrix. You input problems by typing in titles, headings and your numbers. Where you need calculations, type in simple formulas (+, -, ×, ÷) or insert built-in functions such as net present value and averaging. As quickly as you type it in, VisiCalc calculates and displays the results.

"I am extremely impressed with VisiCalc's capability, flexibility and orderly presentation of instructions."

So writes the director of a New York corporation. He appreciates VisiCalc's powerful recalculation feature. Change any number in your model and instantly all numbers affected by that change are recalculated and new results are displayed. You can ask "What if . . .?", analyzing

more alternatives and forecasting more outcomes. It really increases your decision-making batting average!

When you finish, you can print a copy of the worksheet just as it appears on the screen and/or save it on diskette.

"I like VisiCalc's ease of use."

That response comes from a Utah businessman using VisiCalc for production forecasts, financial report ratio analysis and job cost estimating. Ease of use is VisiCalc's best-liked feature. It's designed for a non-programmer, and has an extensive, easy-to-understand instruction manual.

Users also like solving a wide variety of problems with VisiCalc . . . and solving them their way. VisiCalc can even justify the cost of a personal computer, according to a New Hampshire financial analyst:

"VisiCalc is paying for itself over and over."

VisiCalc is available for 32k Commodore PET/CBM, Atari 800 and Apple disk systems. VisiCalc is written by Software Arts, Inc.

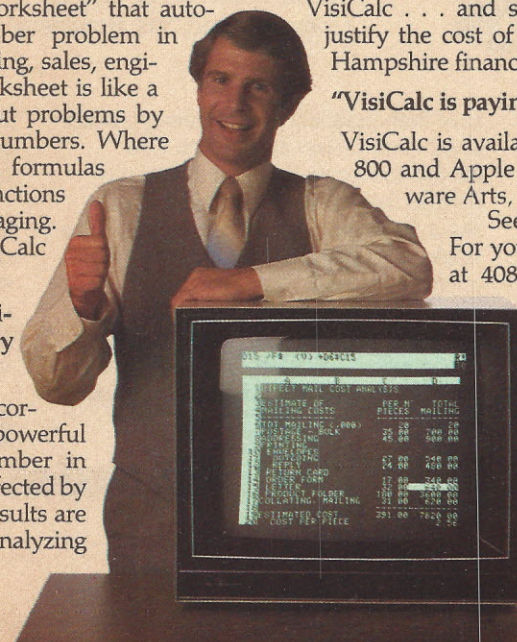
See VisiCalc at your Personal Software dealer. For your dealer's name, call Personal Software Inc. at 408-745-7841, or write 1330 Bordeaux Drive, Sunnyvale, CA 94086.

While there, see our other Productivity Series software: Desktop Plan and CCA Data Management System. They're like time on your hands and money in the bank.

**PERSONAL
SOFTWARE**

CIRCLE INQUIRY NO. 58

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LETTERS

it. It is almost as though the Pet were not a system to be considered seriously. And there is very little more on the 6502 processor. Am I truly marooned on a gradually melting iceberg?

Possibly I should have become concerned when query letters to the vendor met with inadequate responses (admittedly the subject matter may have seemed trivial to anyone but me). Another thing that should have given me pause were the poorly written and un-indexed instruction manuals. However, this is much like crying over spilt milk. Is there anyone out there in your vast readerland who could offer words of encouragement to this hapless soul?

J. Paul Morris
Community Services of Christ Chapel
117 E. 8th, Suite 816
Long Beach, CA 90813

The staff of our high school is in the process of designing a computer literacy and microcomputer assisted teaching program. We are urgently in need of information from individuals or organizations that have been involved in such programs or made studies of the use of the computer in secondary education. Our needs lie particularly in the areas of information on implementation of microcomputers in the curriculum and information on the availability and the most advisable selection of both hardware and software. We are also looking for the names and addresses of other persons or organizations from whom we may solicit information.

Florence Pettit
Neelin High School
10th St. and Brandon Ave.
Brandon, Manitoba, Canada

Our school district is seeking to purchase a program in Basic that simulates Fortran. The program will be used to teach introductory Fortran and need not handle programs longer than 50 or so lines, nor should it necessarily handle data files. There should be a capability of saving Fortran programs onto disk, and for obtaining hard copy of both listings and output (using standard Fortran commands).

We are most interested in obtaining this program for the Apple II Plus computer (Applesoft Basic), although we would like to hear from anyone who has such a program running on any machine.

William J. Wagner
Mountain View High School
650 Castro St.
Mountain View, CA 94041

REAL WORLD INTERFACE FOR YOUR APPLE II A/D + D/A

Commercial, scientific, and industrial data acquisition and control functions are now practical with Mountain Hardware's A/D + D/A card. Superfast conversion time permits high frequency and other applications not possible with slower cards.

If you've got a data acquisition or control application, Mountain Hardware has the answer with A/D + D/A. Drop by your Apple dealer and put your world on a silver platter.

A/D + D/A features:

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- Multi-operating system
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CIRCLE INQUIRY NO. 61

Computer group formed for investment management

A nonprofit organization has been formed to supply professional quality management investment programs. The Microcomputer Investors Association, Fredericksburg, VA, publishes a journal that offers its subscribers a wealth of information and programs applicable for investors and stockbroker/analysts who use microcomputers.

Information is available from Jack Williams, MCIA, 902 Anderson Dr., Fredericksburg, VA 22401.

National career network computerizes job market

The first national multiple listing of job opportunities and resumes compiled through select recruiting firms coast to coast has been computerized. Computer Search International, Baltimore, MD has

placed the data on the information network of The Source, according to John C. Ahlberg and Michael D. O'Connell, founders of the company.

The Career Network is supported by a membership of executive recruiting firms in major metropolitan centers throughout the U.S., England and Australia. Descriptions of corporate job opportunities and individual resumes are listed within the vast program for all users of The Source to see. Individuals and corporations can quickly sort through the job market data with reference to salary range, geographic location, job experience, education, special skills, and a practically unlimited keyword selection of specifications. This sorting process allows facile organization of thousands of job opportunities or resumes in any of 40 job categories, displaying the several that apply perfectly to any applicant or corporation.

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an application that interests everyone with a manual everyone will love

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Othello champion attributes success to computer sparring partner

Jonathan Cerf, winner of the 1980 International Othello Tournament in London, attributes his success to practicing against a computer program.

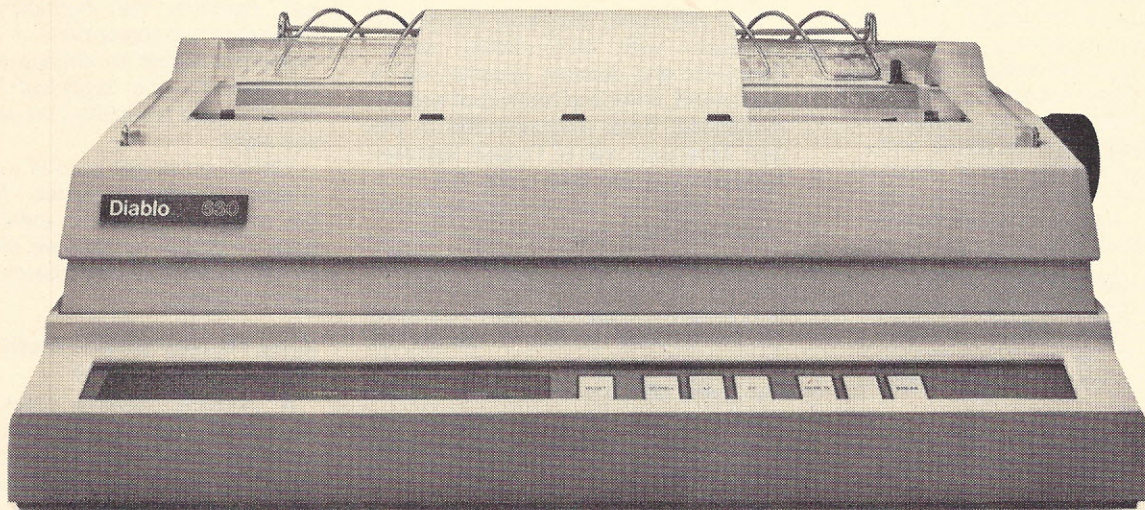
Last June, in the First International Man-Machine Othello Tournament, Cerf (son of the late author and publisher Bennett Cerf) lost to a computer program called Reversal. Ironically, he had advised Reversal's designers on improvements just before losing to it.

Last summer, Cerf retired to Martha's Vineyard with an Apple computer and a disk holding the program to get ready for the fall competition. "Reversal plays end games perfectly," Cerf said. "This is one of my weaknesses. It looks ahead at literally every possible move to the end of the game and picks the best next move. This is something almost impossible for humans. I learned a lot by watching it." His world championship was the first by an American. Previous contests have been won exclusively by the Japanese. Cerf lives on Manhattan's Upper East Side and is a freelance author of arithmetic books when not trying to beat the computer.

Worldwide non-impact printer market to reach \$2.7 billion

The worldwide market for non-impact printers will grow at 23% annually between 1980 and 1985, according to Strategic Business Services, San Jose, CA. Sales of non-impact printers in 1985 will represent 37% of total shipments, compared to 24% in 1980.

If you want a choice in print wheels, there's only one choice in printers.



The Diablo 630.

It's the only printer that lets you use either metal or plastic print wheels. So you can choose the print wheel that's just right for the job.

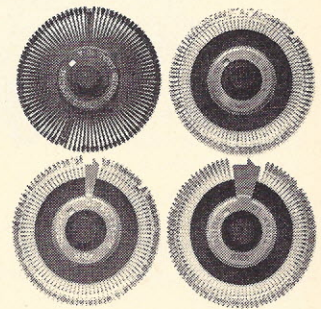
The 630 works as well with a 96-character plastic daisy print wheel as it does with an 88-, 92-, or 96-character metal daisy print wheel. In over 100 different type styles.

Every 630 has fewer moving parts than competitive printers, which makes it more reliable. And it offers unsurpassed print quality. Compatibility with Diablo supplies. And bi-directional printing capability.

The 630 is the only printer in the world that uses both metal and plastic wheels.

So if you want to change your print wheels, you'll just have to change your printer.

To a Diablo 630 printer.



Diablo Systems

XEROX

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Don't blame the operator



Blame Static

This isn't the first time the screen has gone blank "for no reason." But there is a reason. Video wipe-out is only one of the problems static can cause with electronic equipment like computers, word processors and electronic cash registers. As little as 500 volts can cause memory loss or alteration, faulty data, unwanted mechanical actions—even permanent damage to sensitive control and logic circuits.

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For less than the cost of that call, however, you could be rid of static for good.

3M Static Control Floor Mats can create an inexpensive "island of protection" around delicate electronic office equipment, harmlessly draining static charge from operators and other personnel.

3M Static Control Floor Mats are one of the most economical ways available to be sure that your equipment is up when you need it.



3M Static Control Floor Mats come in hard mats for easy movement of casters chairs, and soft mats for comfortable standing. For information about how you can purchase 3M Static Control Floor Mats, call toll-free

1-800-328-1300.

(In Minnesota, call 1-800-736-9625.)

Ask for the Data Recording Products Division

3M Hears You...

3M

UPDATE

From a current shipment base of \$1.2 billion, non-impact printer shipments will reach \$2.7 billion in 1985.

Non-impact printing technologies have supplanted impact printers in several areas because of cost effectiveness. Impact devices are limited by inertia in very high-speed printing applications; non-impact printers, by reducing the number of mechanical components, reduce inertia, as well as cost.

Electronic telephone directory revolutionizes listings

Four electronic telephone directories, complete with illustrations, advertisements and detailed descriptions of ski resorts, hotel and restaurant accommodations, were demonstrated in the first American test of French videotex technology at Big Bear Lake, CA.

The directory—combining telephone, black-and-white television type screen and alphanumeric keyboard—allows the user to type out a request for information which then appears within seconds on the terminal screen. It makes the printed telephone directory a thing of the past, offering a faster, more accurate, and—with mass production—cheaper alternative to the bulky published directory.

Superchip technician predicts amazing capabilities

Tomorrow's "superchips"—postage-stamp-size computers that will outperform the massive electronic brains that are currently as big as bank vaults—may enable us to talk to our home appliances and free us from ever again having to commute to work.

"This situation resembles the development of the laser 20 years ago," says John E. Nelson, research assistant at the University of Southern California. Nelson is acting director of USC's just-formed superchip research unit, the Digital Integrated Systems Center (DISC).

"First the laser was discovered, and only then did scientists begin to figure out today's exotic uses for it, such as repairing eye damage and vaporizing brain tumors. Likewise, when scientists built the first computer, it was so big that nobody thought about putting computers under the hoods of cars to regulate engine performance—until we had today's generation of microprocessing computer chips.

"So the only certainty about tomorrow's generation of computer chips—which we expect to evolve in the next decade from a current maximum of 100,000 transistor-like components to

10 million—is that the new chips will do things we haven't dreamed of."

For example, he says he expects the amazingly compact computer chips of the future to make data-bank network connections as available as today's telephones—perhaps within 10 to 15 years—coincidentally eliminating home-to-office transportation for many of us just when such gasoline conservation will be needed most.

And, because superchips will be endowed with "nerve" cells by the millions, Nelson believes superchips can become the humanoid brains necessary for tomorrow's military and consumer robots to engage in "signal processing"—the technical term for sensory skills resembling human speech and sight.

"What we've got here is a scientific dream," Nelson concludes. "We're on the verge of a fantastic solution for all kinds of things, so now we really need to concentrate on the search for relevant problems."

News release service instituted for micro community

A recently formed news release service will provide small companies in computer and related markets with the ability to get their messages to the news media at a nominal fee. Currently there are a large number of firms that can not afford the cost of marketing their products through full service agencies.

For \$75, the agency will send typed news releases to 126 computer-related periodicals and newspapers throughout the U.S. and Canada. Special requested periodicals or newspapers can be added at additional cost.

For an additional \$75, the company will professionally write the news release and send it out in news release format. Services are also available for multipage and news releases with pictures.

Contact Marvin Silverman at Creative Marketing Services Group, Irvine, CA.

Rival consumer data base slated for fall '81

The dawn of the consumer data base networks became reality with the startup of the The Source and Micronet. It now looks as if another is about to enter the competition: Access (American Consumer Communications, Entertainment Systems Service) coming out of Santa Ana, CA, is expected to go online toward the end of the year. Carl Burlin, president of the net, invites anyone seeking more information (or possible employment) to contact him or Robert Hustwit at (714) 535-7762 or (714) 953-4061.

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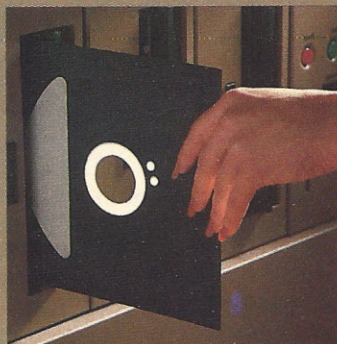
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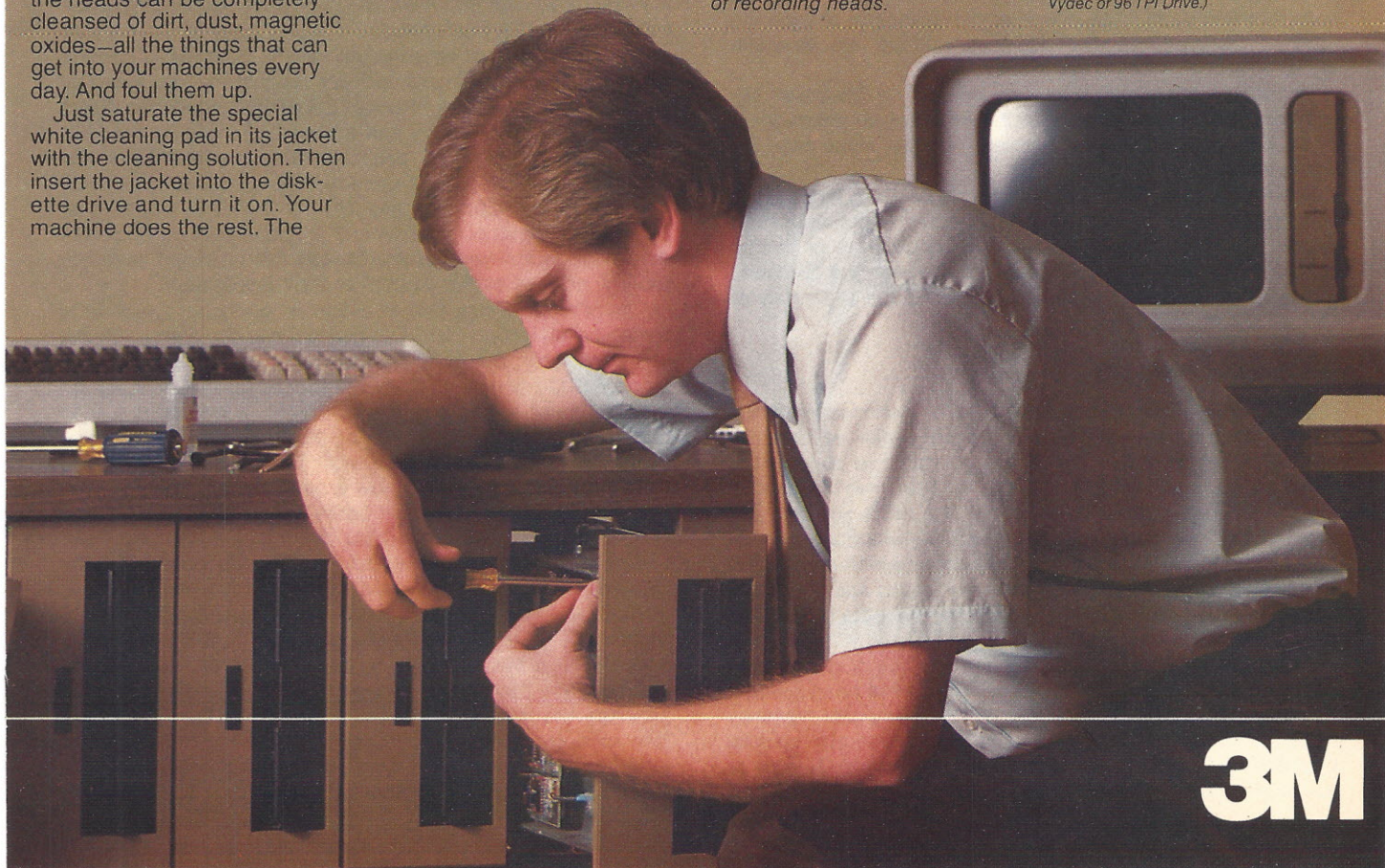
A Scotch cleaning diskette shown before use, and after 15 cleanings of recording heads.



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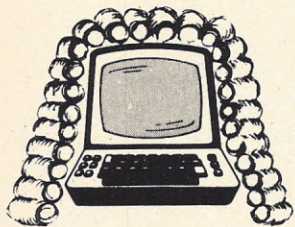
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JURISPRUDENT computerist



By Elliott MacLennan
Attorney at Law

Tax and Legal Structures for Computer and Technologically Oriented Businesses

In this column an overview of the opportunities, pitfalls and planning techniques available to a computer business from the legal and income tax perspective is presented. The discussion will proceed from the presumption that the business under consideration is a sole proprietorship seeking advice on entity selection for expansion, availability of fringe benefit for owners and employees, and ultimately minimizing the effects of business failure.

Sole proprietorship. The traditional start-off style of beginning a small business has few planning possibilities: small leeway is afforded to shift the income tax burden from higher tax bracket to lower tax bracket individuals; fringe benefits are at a minimum; the proprietor is exposed to the maximum possible legal liability; management flexibility simply does not exist; it is a poor means of generating venture capital. Why adopt this form of doing business: In one word: simplicity. The sole proprietor is his or her own boss. Nor is the spectre of government regulation present in this form of doing business.

When the operational business environment of the sole proprietorship stimulates a need or preference to change the form of business several business entities are available for selection.

In reality, the ways one can operate a business are manifold. Below are several forms of business operations. Their individual distinctive features will be highlighted by brief discussion.

Business trusts. Simply put, this form of doing business is no longer popular. In fact it is going the way of the dinosaurs. It was the forerunner of the modern corporation or limited partnership. Legal liability exposure is present to a maximum to the active operators of the business and the availability of fringe benefits are few.

Protection for tenants

Co-tenancy. Theoretically, this form of business would be ideal. Although each co-tenant is arguably shielded from the errors and omissions of the other co-tenants, a co-tenant is exposed to legal liability for his or her own actionable mistakes. The Internal Revenue Service (IRS) you can bet more often than nought will classify the co-tenant as partners with frequent and severe income tax consequences resulting where this classification was not anticipated and therefore not planned for. The availability of fringe benefits is identical to that of the sole proprietor: nil.

Joint venture. Technically, this is a species of partnership limited in scope and duration. Commonly, it has been called a one-shot partnership. This is misleading. Many joint ventures exist for over twenty years and often operate several businesses. Courts, to the extent they can, employ the law of partnerships to construe the structure and operation of joint

ventures. Aside from a minimum number of fringe benefits each joint-adventurer is fully exposed to the errant ways of the others. One way to minimize this liability is to make each joint adventurer a corporation and thus shield the liability of a joint venturer to only the assets in the corporation.

Where it is critical to avoid this form of doing business is in a situation where non-management type investors are involved in a "deal" involving substantial tax shelter aspects. For our purposes a "tax shelter" shall be defined as tax free borrowing of money from the United States government, especially in the earlier years of the venture. (But reader, some would say that a tax shelter is a means by which a taxpayer throws money away at a controlled rate expecting in return significant tax benefits.) The specific reason why a joint venture should be so avoided here is because the usual form of such ventures is the limited partnership and although the joint venture and limited partnership may be identical in design and operation down to the last word, the limited partnership has the benefit of certain statutory and judge-made rules making more predictable its critical tax consequences than does the joint venture.

General partnership. Management flexibility is possible here: one partner may speak for several. But again, unlimited liability is still present for all partners. A general partnership is an association of two or more persons to carry on a trade or business for profit (or loss). The general partners all have a right to participate in management. Any partner may be a "silent partner," that is, this partner does not voice opinion on management operations. Nonetheless, a silent partner is exposed to unlimited liability for the acts or omissions of the other partners.

Avoiding a parade of horrors

Most states allow a general partnership to be oral as opposed to being written. Therefore, it provides an inexpensive means of forming an association of individuals to prosecute active business operations. Anyone considering any business venture with associates without stating the exact business agreement in writing, given the changing and litigious climate of the American business environment today, is likely to be cast into a parade of horrors too lengthy to be mentioned in this brief column.

Although some income tax planning is possible in general partnerships, arrangements between the partners motivated by sheer tax considerations that lack substantial economic effect will be subject to scrutiny and ultimate rejection by the IRS.

General partnerships present dismal possibilities for attracting investor capital. Realistically, investors usually do not like to participate in day to day business operations. Again, regardless of what type of management participation they engage in investors are exposed to unlimited personal liability, not just to the amount of their investment.

The principal fringe benefit available to a general partner is the so-called Keogh Plan. The general partner, along with the sole proprietor, can defer taxation up to (generally) not more than \$7,500 per year on his or her federal tax return. A Keogh Plan does not permit self-administration; it mandates a rigid contributory formula that must be met regardless of whether the partnership is profitable or not! The type of investments the Keogh Plan can make by law is severely restricted and the plan participants must, in most cases, wait until the age of 59½ before becoming able to extract distributions from the Plan.

Limited partnership. This form of doing business is strictly by statute; it cannot be oral. The limited partners are the capital investors. They are exposed to legal liability only to the extent of their investment provided that they take no active role in management of the partnership. The general partners are the active managers. The limited partnership provides the greatest possibility of tax planning. Generally, this form is not used to conduct an active business. An example of its use may be where an investor seeks capital to research, develop and market an invention. He establishes

THE DAWN OF A NEW AGE

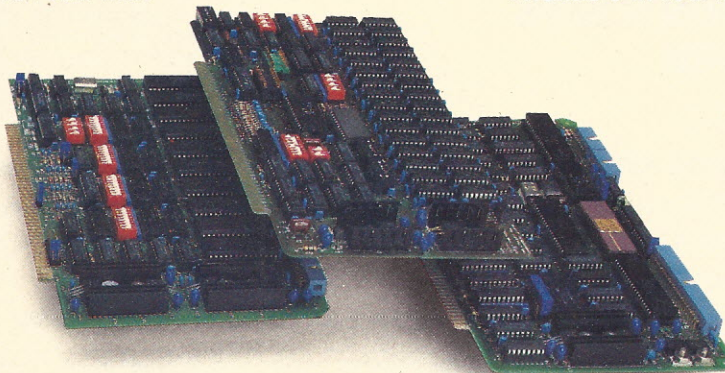
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himself as a general partner with his "invention" being the technological idea. He obtains investment capital from limited partners. During the early years of development practically 100% of the often leveraged tax benefits can be allocated to the limited partners who need the tax breaks where the inventor usually does not. After a given production quota is reached and the limited partners have received their capital back the rights to the invention which were temporarily licensed to the limited partners revert back to the inventor. The limited partnership is thus a "rain-barrel" for collection of investor capital. Structured correctly, a limited partnership can prevent vulture capitalists from taking control and domination of the inventor's brainchild.

Workhorse of American business

The two corporations discussed below do not offer the same advantages tax wise to the investor. In both corporations the pass through of operational losses and expenses—the essence of any "tax shelter" arrangement—is severely restricted. Furthermore, the corporate investor is not just a transient: he or she becomes a "resident alien" in your business; often controlling substantial voting rights, privileges and preferences.

Subchapter "C" corporation. The C corporation is the workhorse of American business. Its principal drawback it often seems, is that it is double taxed—distinguishing it from every other business form under consideration by this column. The double tax occurs as follows: it is taxed once when income is received at the corporate level and taxed again at the shareholder (owner) level when corporate profits are distributed in the form of dividends to shareholders.

In reality, the small family or "closely" held corporation does not have dividends to distribute. Dividends are not deductible; bonuses and retroactive salary increases that are reasonable in amount and are a reward for personal services rendered are. It is the job of the legal-tax planner to avoid distributing nondeductible dividends where it is permissible to declare bonuses.

The C corporation is simply one massive income-averaging device. Unlike its relative, income averaging for individuals, which can only mitigate the tax consequences of minor tax ripples in income, the C corporation can effectively flatten out wild fluctuations in income often found in personal computing businesses. Income fluctuations or "spikes" produce harsh tax results because of our progressive rate of taxation.

A taxpayer benefits from a C corporation when he or she has income above disposable personal income that can be left in the corporation (fattening up the corporate calf) where the tax bracket of the corporation is lower than that of the taxpayer. Contrary to popular belief there is no mathematical or accounting formulae to determine when to incorporate for tax purposes: it depends upon your individual life style!

Share certificates useful

Where properly capitalized and operated a corporation exposes its shareholders to legal liability only to the extent of their holdings in the corporation. Generally, a corporation can be safely capitalized from \$100 to \$500.

Moreover, the existence of share certificates makes it easy to transfer ownership and provide for beneficial "income-splitting" tax planning without having to have a substantial economic effect for the transfer—as is the case in partnerships.

Without peer, the C corporation provides the most tax free fringe benefits. Discussed below four benefits are available only to the C corporation only the first three operate on what is called in tax parlance the "D and E effect." They are deductible (D) to the corporation and excluded (E) from the recipients income tax return. Thus the C corporation benefits from a deduction reducing its income exposed to taxability. Correspondingly, the recipient receives a valuable benefit that, by not being reportable for tax purposes, does not "push" the recipient into a higher tax bracket.

Pension and profit-sharing plans. The qualified corporate pension and profit-sharing plans tower over the inflexible investment restriction and contribution limitations found in the Keogh Plan. A plan participant need not be 59½ years of age to retire. The corporation can elect to make yearly mandatory contributions: this is a pension; or it can adopt a profit sharing plan requiring contributions in the discretion of the corporation only when it is profitable. (The contributions must be substantial and recurring however.) A corporation can have both a pension and profit sharing plan. Lastly, like the Keogh Plan, accumulation of plan funds is tax deferred until distribution.

Medical reimbursement plans. Such a plan can provide accident, health, disability, dental and way continuation protection to a recipient and allow the corporation a deduction for every penny spent. Is this true for an individual taxpayer? No. An individual may only deduct paid medical expenses if they exceed 3% of his or her adjusted gross income.

Group term insurance. A corporation may deduct and a recipient may exclude the premium cost of up to \$50,000 of term life insurance. Term life insurance does not have a cash surrender value.

Presumption of doing business. This is not really a fringe benefit at all. What this presumption does is create an automatic bias in favor for C corporations. For example, it mitigates IRS attack on the grounds that taxpayer is not engaged in profit making activity. An attack commonly known as the "hobby loss effect" that finds particularly vulnerable victims in a business activity that will have several years of operational losses before becoming profitable.

Subchapter S corporation. This corporation has two principal advantages; single not double taxation and the ability to "pass through" to its shareholders its operating losses for deductibility on their personal tax returns. The S corporation produces significant tax effect in only two circumstances: when the corporation has operational losses to pass through

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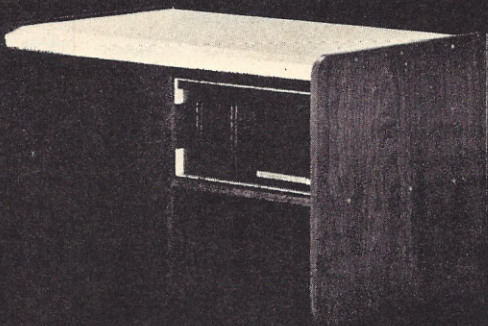


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to its shareholders, for example in business or manufacturing "start-up" situations and where the corporate business activities are so profitable that there exists no possibility the IRS will allow all the amounts paid for services rendered to it by its employees. If in a C corporation, for instance, if the amounts so paid are classified as unreasonable or not for personal services rendered the IRS can deny a deduction for those amounts and double tax them as "disguised" dividends.

Acquisitions and mergers. Frequently in the time-course of a given business it is prudent to acquire or be acquired by another corporation. Whether one labels the process as a merger, acquisition, consolidation, amalgamation or the like, a change in form of doing business occurs. Where a business can convince the IRS that all that has occurred is a change in form the IRS will not tax the transaction even though significant tax deferral is present: the theory being that it is the wrong time to tax a business when all that has occurred is a change in its form.

The common phrase given to the means of obtaining tax deferred changes in business form is the "Alphabet Reorganizations." This phrase is appropriate as the Internal Revenue Code provides substantial flexibility in accomplishing the desired change under its A, B, C, D, E, and F reorganization provisions.

Separation of associates

Business buy-out arrangements. Often more critical than reducing one's business arrangement with one's associates to a written document is the need to provide a workable pre-determined formula for purchasing the interest of a departing or disgruntled associate. A Buy-Out Agreement should provide for the eventuality of death and departure by choice, whim, expulsion or disability. Such an agreement is especially attractive where bank or investor capital is present. These two capital sources fear the injection of inexperienced or "outside" management personnel entering the business upon death or departure of key management personnel.

Business failure. Planning can mitigate the harshness of failure. Aside from bankruptcy or creditor reorganizations, two planning possibilities are discussed below to demonstrate the mitigative effect.

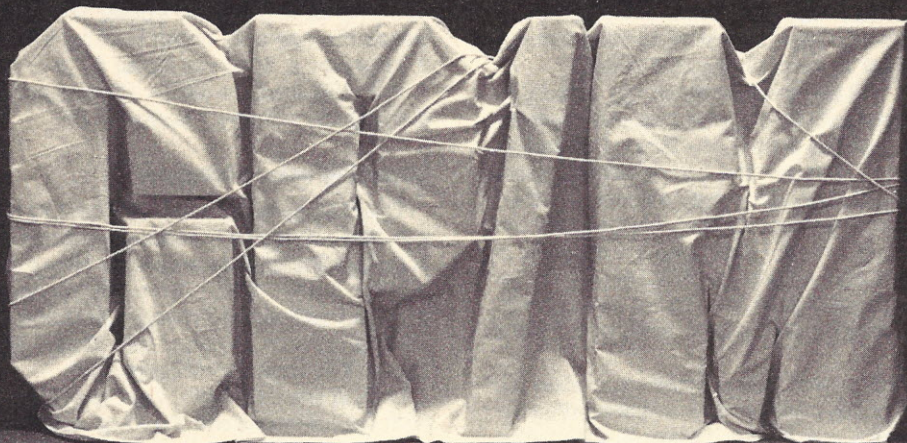
Losses on small business stock. When a corporation goes under any business losses on its capital stock are deductible on a shareholders personal tax return up to a maximum of \$3,000 per year (that can be carried over until the loss deduction is exhausted). If a corporation has a \$100,000 loss with only one shareholder he or she can deduct \$3,000 a year for the next 33 1/3 years. This tax break is insignificant.

The same corporation can qualify for a "1244 Plan"—the only section in the Internal Revenue Code (Section 1244) that will not hurt a corporation if it succeeds or fails. The 1244 election allows the same shareholder a \$50,000 deduction per year (\$100,000 if married) until the loss is exhausted when the stock in the corporation becomes worthless. The point being that if subsequent to the corporate failure the shareholder takes a job for \$25,000 per year he or she will not pay a penny in federal taxes for at least the next four years.

"Trafficking" in net operational loss corporations. Assume a corporation that has failed to the degree that its stock is not worth the paper it is printed on, but, because of the failure, it has substantial operating losses. A profitable corporation in a related trade or business to that of the defunct corporation may wish to acquire the assets (and net operating loss) of the defunct corporation. Often a handsome price can be realized for that "worthless" stock because of the substantial tax benefits the loss will have when transferred to the profitable corporation.

Successful legal, business, and tax planning helps a business by shielding it from legal liability, maximizing its profit goals and minimizing its tax profile. Each business operation is unique. As a corollary to this uniqueness a "printed form" approach to running a business simply lowers the ceiling of successful business results. □

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The Numbers Game

This fast-action number recognition game is designed for preschool children just learning their letters and numbers. It is even better for adults who want to test rapid hand and eye coordination without a lot of deep strategic thinking.

The program places 100 digits randomly on the screen. At the top of the screen are displayed player scores and a number to be selected. Each player has control of a blinking on-screen box, and uses a joystick to move the box to any of those digits within the 100 digits that match the computer number.

Once he finds a match, he presses the joystick button to pick it, and scores. As soon as either player succeeds in finding and picking the computer's number, the computer chooses and displays a new digit. If the digit is not a match, nothing happens. The players must continue looking for the correct digit.

The Numbers Game is a short, tricky program. It uses the full power of the Radio Shack joysticks to move around on the screen. It also uses 'peeks' and 'pokes' to look at and change the TV screen image.

The loop from line 110 to line 150 places the random digits on the screen. Usually this will be less than 100 numbers since the program lets the digits write on top of one another. Digits displayed later can wipe out digits displayed earlier. Notice line 120. The variable X is set equal to a random number between 31 and 508. When used as a screen location by the print statement on line 140, X limits digits to lines 2 through 16 on the screen.

Since position 31 is the last character on line 1, you might think this is a bug. It isn't. Color Basic precedes all printed numbers by a blank. If X is equal to 31, this blank would print at the end of line 1. The digit would print in the first position of the next line. Likewise, any value of X above 508 will cause the TV screen to scroll.

Lines 190 to 250 initialize each round of the game. The number to be matched for the round is picked on line 190 and displayed along with the current scores by line 200.

Converting directional positions

Lines 210 and 230 are a fast way to convert joystick positions into screen positions. 'Joystk(0)' is the left joystick horizontal position. This number ranges between 0 and 63. Taking the integer of this number when divided by two converts it into a horizontal position on the TV screen between 0 and 31. 'Joystk(1)' is the vertical position of the joystick within a range of 0 to 63. Taking the integer of this number after dividing by four converts it into a line on the TV screen from 0 to 15. Multiplying by the length of a line (32) and adding the position on the line gives the location on the screen represented by the position on the left joystick. The equation on line 230 does the same for the right joystick.

Line 220 takes the computed screen location and removes the ability to select locations on the first line of the screen.

Any position chosen on the top line is converted into the same position one line down.

The computer memory, which represents the TV screen, begins at location 1024 inside the computer at the upper left of the screen. Poking a number into this location will display something in the upper left corner. If the number is 112, a black zero will appear. If the number is 48, a green zero will appear on a black background. The numbers 113 and 49 will display a green and black 1, and so on.

The rule is that subtracting 64 ($112 - 64 = 48$) from the number in memory representing a position on the screen will convert it from a black symbol on a green background into a green symbol on a black background. Look at line 240. 1024 is added to the variable A to convert it into the actual memory location of the joystick position on the screen. The number at this location is peeked from memory, 64 is subtracted from it, and the result is poked back into the same location. What happens to the TV screen? The digit is reversed. It is now a green symbol on a black background.

Line 250 does the same things for the right player, but with one change. If both players are at the same screen location, an additional 64 should *not* be subtracted. If $A = B$, the equation $(A <> B)$ is false and equals zero. Multiplying 64 by zero leaves the contents of the memory location at B unchanged. If, however A does not equal B, $(A <> B)$ is true and equals -1. In this case, $+64 * (-1)$ will subtract 64 from the contents of the memory location at B.

Changing color locations

The main game loop is from line 290 to line 390. Lines 290 and 300 change the screen locations back to their normal color and line 310 determines if either player has pressed his joystick button. If not, lines 330 to 380 determine the new joystick positions and change the colors of these locations on the TV screen. Notice that these lines are functionally identical to lines 210 through 250.

Look at line 310 again. The 'inkey\$' function is used to read both the keyboard and the joystick buttons. Pressing the left joystick button is the same as pressing all eight keys A through G and @ at the same time. Pressing the right joystick button is the same as pressing keys H through O at the same time. If no keys are pressed, A\$ = "" and no action is taken. Otherwise, the button routine beginning on line 430 takes over.

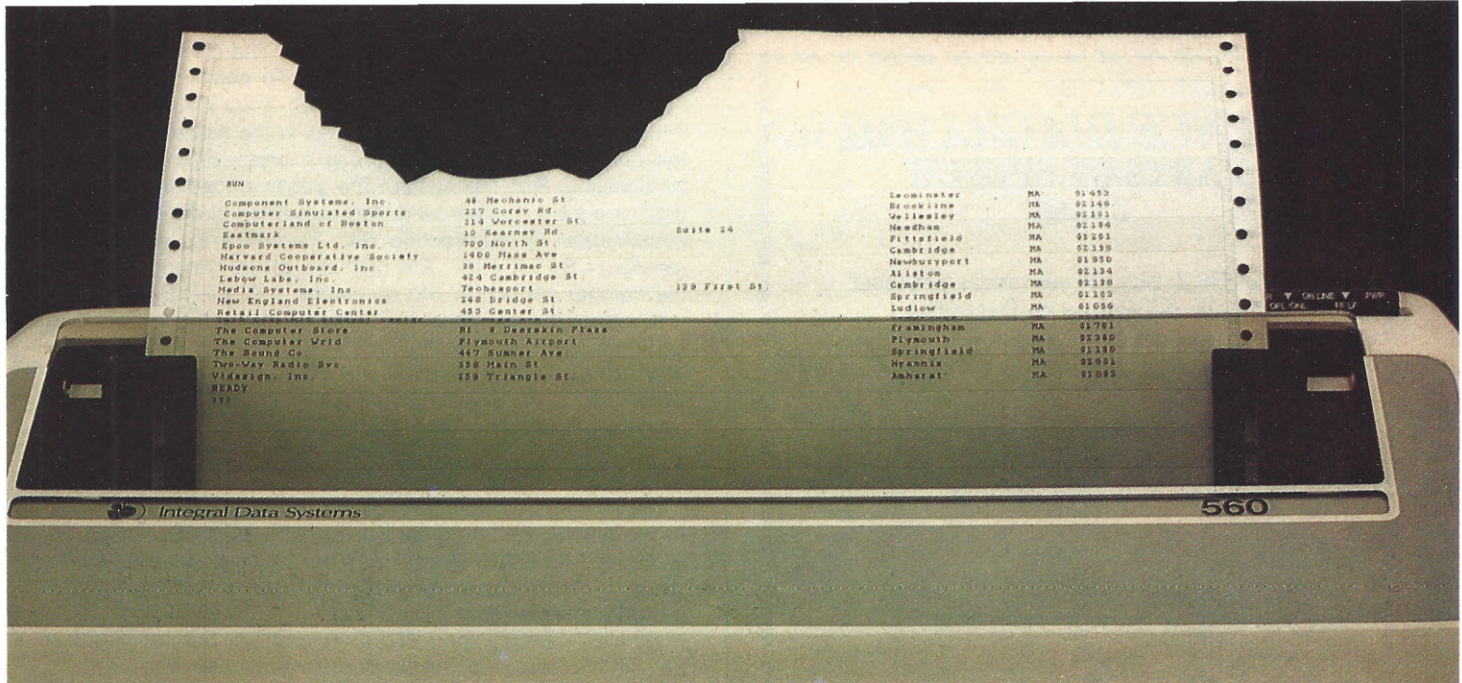
The routine from line 430 to line 550 takes care of player scoring. If the right player presses his button, the value of A\$ can be anything from "H" to "O". These are all greater than

The Inner Solar System						
NAME	NUMBER	GRAVITY	X-COORD	Y-COORD	X-SPEED	Y-SPEED
SUN	1	299.0	160	96	0	0
MERCURY	2	0.3	196	96	0	297
VENUS	3	0.9	227	96	0	217
EARTH	4	1.0	253	96	0	185
MARS	5	0.4	301	96	0	150

Gravity inputs based on surface gravity

"G" so line 470 is used. Otherwise, the left player has pressed his button and line 440 is used. In both cases, the computer's chosen number, X, is compared to the digit on the TV screen selected by the player.

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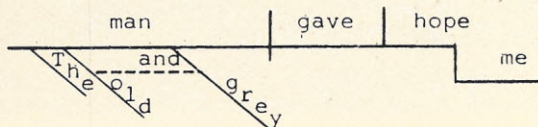
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itself. This is also true with computers. The computer knows the symbol "1" by the number 49. To convert any of the numbers 0 to 9 into its digit, add 48. Thus $X + 48$ converts the number in X into its symbol. This is the representation of the number on the TV screen as a green digit on a black background. But the symbol the player chose was a black digit on a green background. It is converted to the other color combination by subtracting 64. Therefore in line 440, if $'peek(A) - 64 = X + 48'$, the digit the player picked matches the number chosen by the computer.

If either player picks the correct number, his score is updated, the little tune on lines 490 to 540 is played, and a new game round is begun at line 190. If the number chosen was wrong, a single beep is heard from line 450 and the same round continues from line 330.

Reader response

Steve Steinberg was kind enough to send me his revisions to the Atari Orbits program (IA Aug 80). He made two slight changes: in line 210 he replaced the 'color 4' statement with 'color 1'. Now the orbiting objects leave a trail making the program more visually interesting.

He also changed line 1370 from 'graphics 23' to 'graphics 24'. At this resolution, the program generates far more realistic orbits, but at a cost. You need at least 16K of memory. It's worth it.

Steve also sent the numbers to generate a realistic model of the inner solar system. Run the program and tell it you are going to model five objects. Type in the information from the table. As Steve says, "The five objects are respectively, the Sun, Mercury, Venus, Earth, and Mars. The inputs for gravity are based on surface gravity figures in the chart and are exactly the same, except for the Sun, whose gravity I made up to make the Earth's passage around the Sun come out to 365 plotted points.

Steve has taken a simple program and converted it into an enjoyable learning experience—and had a lot of fun doing it. I would like to hear from others who have turned programs from this column into mental "games" for learning and growing. □

Listing 1. Orbits

```

10 REM ... ORBITS"...
20 REM
30 REM
40 REM GO SET UP THE 'GAME'
50 REM
60 GOTO 1000
70 REM
80 REM THE TIGHT DISPLAY LOOP
90 REM
100 TRAP 100:GOTO 120
110 PLOT X(I),Y(I)
120 RETURN
130 FOR EVER=1 TO 1 STEP 0
140 POKE 77,0
150 FOR I=1 TO T
160 FOR J=1 TO T
170 IF I<>J THEN X=X(J)-X(I):Y=Y(J)-Y(I):D2=X*X+Y*Y:
    G=6(J)/(D2*SQR(D2)):U(I)=U(I)+G*X:V(I)=V(I)+G*Y
180 NEXT J
190 NEXT I
200 FOR I=1 TO T
210 COLOR 1 ← changed from COLOR 4
220 GOSUB 110
230 Y(I)=Y(I)+V(I)
240 X(I)=X(I)+U(I)
250 COLOR 1
260 GOSUB 110
270 NEXT I
280 NEXT EVER
1000 REM
1010 REM SET UP GAME
1020 REM GET NUMBER OF OBJECTS
1030 REM
1040 PRINT "NUMBER OF ORBITING OBJECTS";

```


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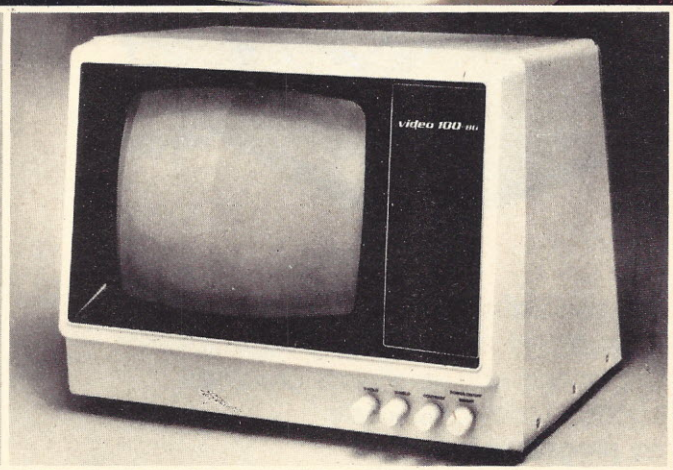
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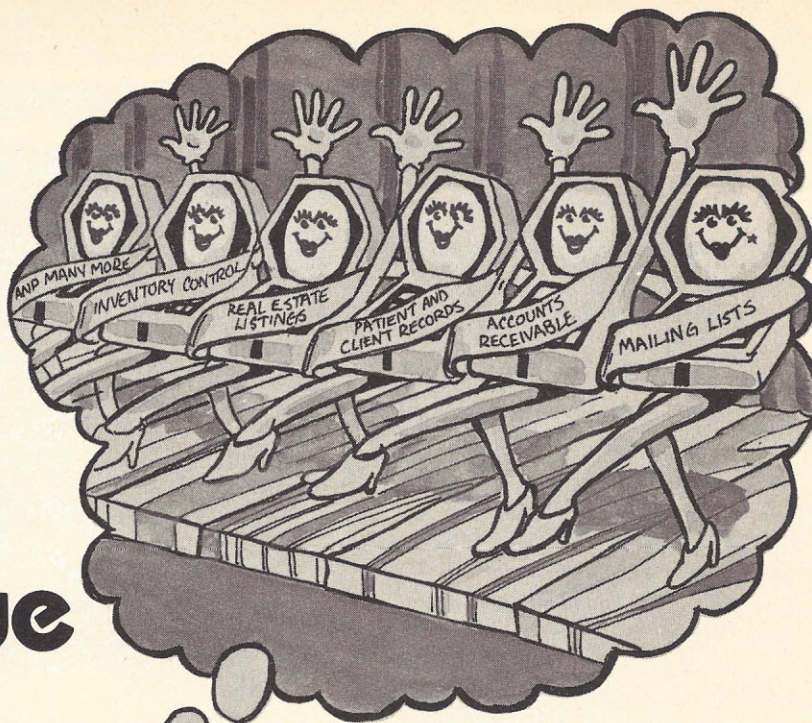
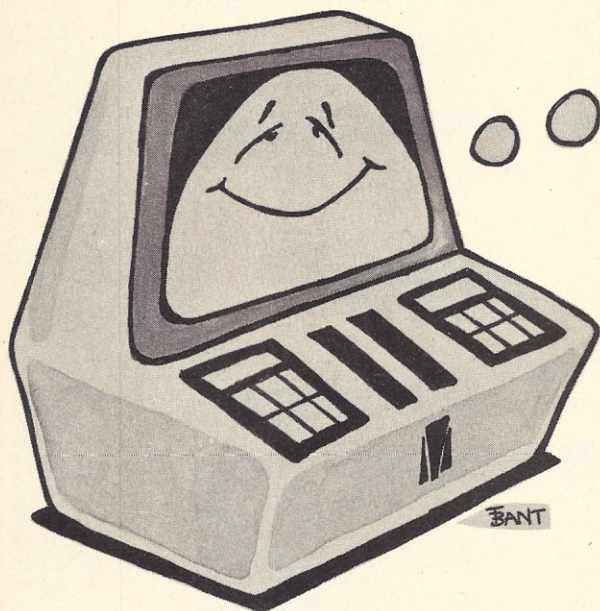
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```

1050 INPUT T
1060 REM
1070 REM NOW SET UP MEMORY
1080 REM
1090 REM I = CURRENT OBJECT
1100 REM T = TOTAL OBJECTS
1110 REM G = PULL BETWEEN OBJECT I & J
1120 REM
1130 REM G(I)= GRAVITATIONAL PULL
1140 REM X(I)= HORIZONTAL POSITION
1150 REM Y(I)= VERTICAL POSITION
1160 REM U(I)= HORIZONTAL VELOCITY
1170 REM V(I)= VERTICAL VELOCITY
1180 REM
1190 DIM G(T),X(T),Y(T),U(T),V(T)

```

Listing 2. The Numbers Game

```

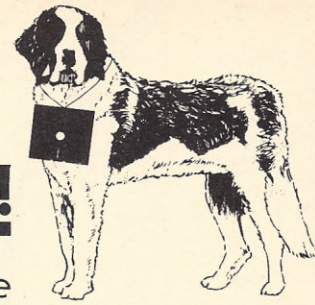
10 REM THE NUMBERS GAME
20 REM
30 REM
40 REM DEFINE PLAYER SCORES
50 REM
60 DIM S(2)
70 REM
80 REM CLEAR SCREEN AND PLACE RANDOM NUMBERS
90 REM
100 CLS
110 FOR I=1 TO 100
120 X=RND(478)+30
130 Y=RND(10)-1
140 PRINT X,Y;
150 NEXT I
160 REM
170 REM BEGIN GAME: SHOW SCORE AND TARGET NUMBER
180 REM
190 X=RND(10)-1
200 PRINT "PLAYER1=";SC(1);"PLAYER2=";SC(2);"FIND";X;
210 A=INT(JOYSTK(0)/2)+32*INT(JOYSTK(1)/4)
220 IF A<32 THEN A=A+32
230 B=INT(JOYSTK(2)/2)+32*INT(JOYSTK(3)/4)
240 A=A+1024:POKEA,PEEK(A)-64
250 B=B+1024:POKEB,PEEK(B)+64*(A<>B)
260 REM
270 REM PLAYER INPUT LOOP
280 REM
290 POKEA,PEEK(A)+64
300 POKEB,PEEK(B)-64*(A<>B)
310 A$=INKEY$:IF A$<>" " THEN 430
320 A=1024+INT(JOYSTK(0)/2)+32*INT(JOYSTK(1)/4)
330 B=1024+INT(JOYSTK(2)/2)+32*INT(JOYSTK(3)/4)
340 IF A<1056 THEN A=A+32
350 IF B<1056 THEN B=B+32
360 POKEA,PEEK(A)-64
370 POKEB,PEEK(B)+64*(A<>B)
380 GOTO290
390 REM
400 REM
410 REM HANDLE BUTTON PRESS
420 REM
430 IF A$>"G" THEN 470
440 IF PEEK(A)-64=X+48 THEN SC(1)=SC(1)+1:GOTO490
450 SOUND200,1
460 GOTO330
470 IF PEEK(B)-64<>X+48 THEN 450
480 SC(2)=SC(2)+1
490 SOUND80,1
500 SOUND100,1
510 SOUND80,1
520 SOUND100,1
530 SOUND80,1
540 SOUND100,1
550 GOTO190

1200 REM
1210 REM GET VALUES FOR ALL OBJECTS
1220 REM
1230 FOR I=1 TO T
1240 PRINT "FOR ORBITING OBJECT ";I
1250 PRINT "GRAVITY=";:INPUT A:G(I)=A
1260 PRINT "X-COORD=";:INPUT A:X(I)=A
1270 PRINT "Y-COORD=";:INPUT A:Y(I)=A
1280 PRINT "X-SPEED=";:INPUT A
1290 U(I)=A/100
1300 PRINT "Y-SPEED=";:INPUT A
1310 V(I)=A/100
1320 NEXT I
1330 REM
1340 REM DO FINAL SETUP AND GO DO IT
1350 REM
1360 TRAP 100
1370 GRAPHICS 24 ← changed from GRAPHICS 23
1380 GOTO 130

```

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Implementing Multi-Tasking Basic

In the past two columns, I have introduced the concept of a multi-tasking Basic and have detailed most of the important language elements and features associated with it. As I had pointed out, it remains, at this time, merely a concept. This month, however, I will explain most of the necessary implementation details, as well as the remaining multi-tasking functions, so that some enterprising company or individual can easily develop the necessary interpreter. I describe it here in terms of an interpreter since most existing versions of Basic are already implemented as interpreters, but there is nothing to preclude its implementation as a compiler.

In order to understand the extensions necessary to handle multi-tasking, we need at least a rudimentary understanding of how a standard Basic interpreter works. When we activate an interpreter, by issuing the RUN command, it initializes an internal pointer (maintained, typically, in a double-byte of

memory) to point at the first line of the source program to be run. The program is a source program in the sense that it consists of the actual textual instructions that we typed in as the program; this as opposed to a directly executable sequence of machine-level instructions that might be produced by a compiler translating the source code into machine instructions. This source program might actually be in some compressed form (e.g. each key word such as GOSUB being represented by a token or code occupying a single byte of memory) but, in general, we can think of it as if the entire set of text resides in the source program.

So we have issued a RUN command and the pointer is pointing at the first instruction. The interpreter then scans this first instruction, figures out what it means, and performs it. It might, for example, be a LET X = 9 + 2. The interpreter recognizes that it is a LET instruction, checks for proper syntax, evaluates the expression 9 + 2, checks for the existence of the X variable and creates it if it does not already exist, and then assigns the value of the expression to the variable X.

When the entire statement has been processed successfully, the pointer, which had been pointing at this first statement, is set to point at the next statement in the program. After each statement is processed, the pointer is set to point at the next statement, until there are no more statements in the source program, at which time the program is finished. Simple.

Changing the flow of control

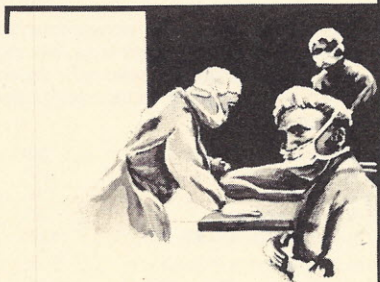
If you've done any programming, however, you know that very few programs run straight from beginning to end. Most often they include branching, conditionals, iterations, and subroutine calls, all of which change the "flow of control."

For simple branching and conditionals (i.e. GOTOs and IF-THEN sequences) the statement pointer mentioned above is perfectly satisfactory since it simply implies that the pointer

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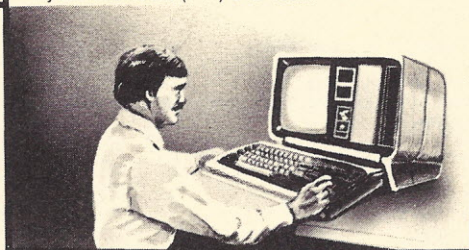
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is set to point at some statement other than the next sequential statement. The pointer is *not* sufficient, however, for iteration (FOR-NEXT) and subroutine calling (GOSUB-RETURN) statements. In both of these cases the computer must remember where it came from.

When a NEXT statement is encountered, the computer must know where the associated FOR statement was. When a RETURN statement is processed it must know where the associated GOSUB occurred in the program. And since FOR-NEXT statements may be nested within each other, and subroutines may call subroutines which may in turn call other subroutines, the computer must have a way of remembering a long sequence of GOSUBs and FORs so that it can know how to properly get back from subroutines and process FOR loops.

This problem isn't as complicated as it may seem and it is handled easily by a data structure known as a stack. Information may be placed into and removed from a stack in a last-in-first-out sequence. When a GOSUB statement is encountered, the interpreter places two pieces of information on the stack: a value which points at the next statement in the program following the GOSUB statement, and a special code indicating that a GOSUB was performed. The interpreter then proceeds to process the specified subroutine.

When a RETURN statement is encountered, the interpreter removes the last item from the stack and checks to ensure that it is a GOSUB code. If it is *not*, then there is something wrong with the program, an error message is generated and the program stops running. If there is a GOSUB code on the stack then the interpreter takes the associated pointer value off the stack (which was put there during the processing of the GOSUB statement) and uses that pointer to find the next statement to be processed.

A similar set of operations are performed for the FOR-NEXT statements. FOR causes certain information to be placed on the stack and NEXT causes that information to be retrieved from the stack. In both cases (GOSUB-RETURN and FOR-NEXT) the stack is used to remember, possibly nested, information during the running of the program.

Now let's consider the case in which we have a multi-tasking Basic program running. We will typically have two or more tasks active at any given point in time during the running of the program. Each such task may include FOR-NEXT statements or calls to subroutines. If all of these tasks were placing information onto and retrieving information from the stack, the interpreter would quickly lose track of what was going on.

Separate stack needed

Consider what happens when one task puts information for GOSUB on the stack and then some other task encounters a NEXT statement. That second task will try to get FOR-type information but the GOSUB information will be what's available on the stack. The second task would assume an error and stop the program. Clearly we will need a separate stack for each task and that is the most important addition we need to make to our standard Basic interpreter in order to accommodate multi-tasking.

The figure displays the stacks and parameters needed to support multi-tasking Basic. In this particular configuration, there can be at most eight concurrent active tasks, indicated by the eight stacks. The number of possible tasks is variable and is specified in the program itself by an `ENABLE__MULTI__TASKING__FOR` statement which has the following form:

```
ENABLE__MULTI__TASKING__FOR number__of__tasks ,
number__of__levels
```

where the `number__of__tasks`, is an integer value indicating the maximum number of tasks that may be active at any time during the running of the program. The default value is one, meaning on task 0, the main program, may run. It cannot be set to less than one.

The other parameter, `number__of__levels`, indicates the number of nested FOR and GOSUB information sets which

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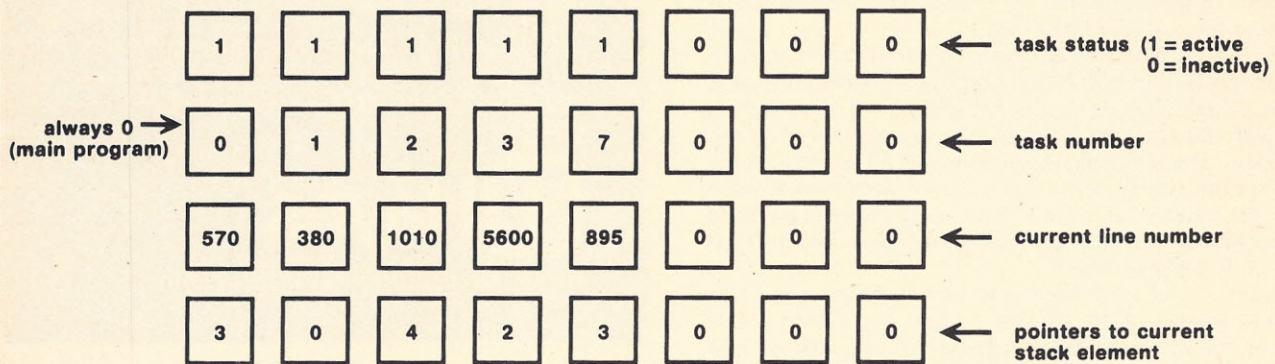
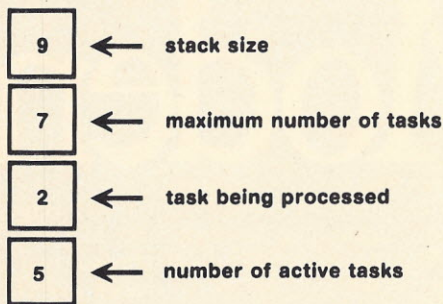


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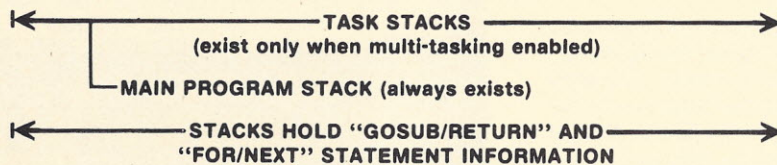
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logical
stack element
numbers

	0	1	2	3	4	5	6	7	← logical stack numbers 0 denotes main program stack
0	0139	C79A	B307	2224	37E2	0	0	0	
1	A2BB	0	1192	7BDE	441F	0	0	0	
2	F107	0	46C3	EF00	9021	0	0	0	
3	0334	0	5217	0	73AB	0	0	0	
4	0	0	ACFG	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	



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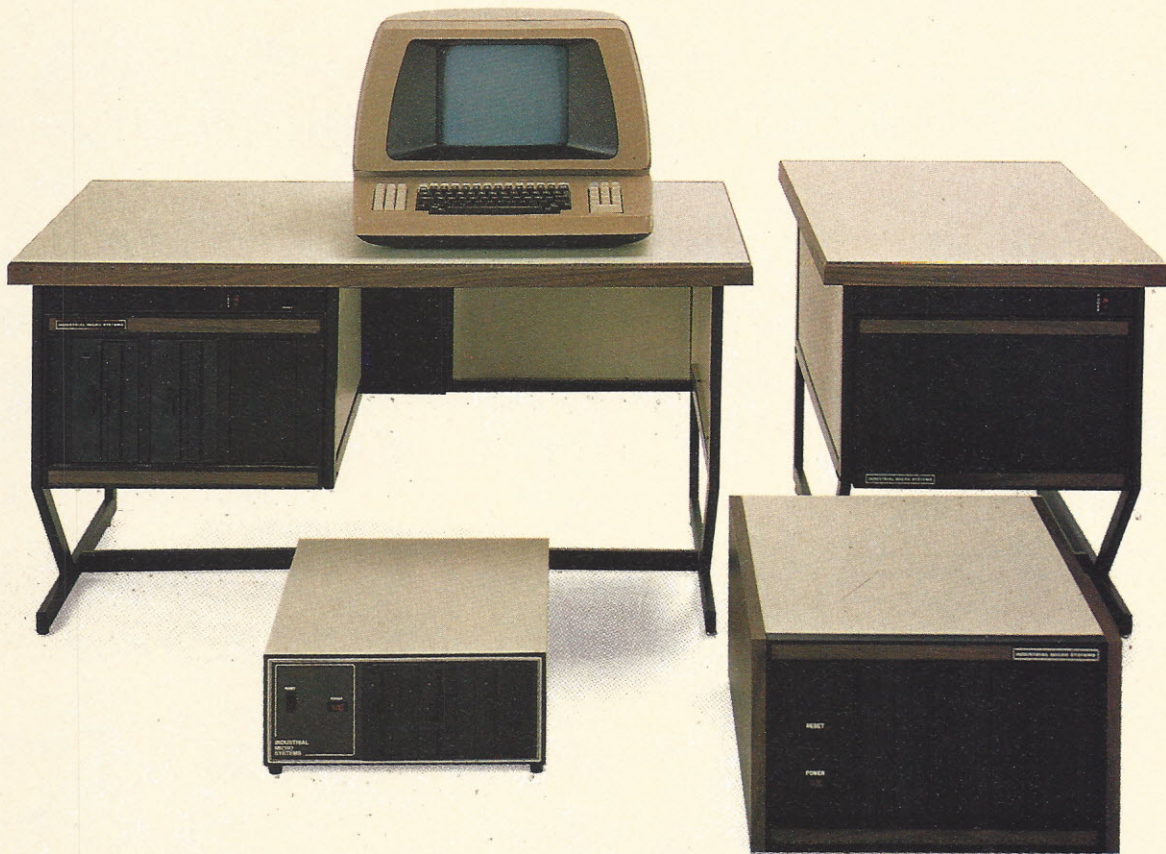
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Table 1
Multi-Tasking BASIC
Statement and Function Syntax Summary

ENABLE__MULTI__TASKING__FOR number__of__tasks, number__of__levels__of__return

examples:

ENABLE__MULTI__TASKING__FOR 6,8 *allows for up to 6 separate tasks to be active at any given time in the program. Each task may have up to 8 levels of nested subroutine calls and/or FOR-loops.*

DISABLE__MULTI__TASKING

note: The function OK(0) is set to 0(false) if there are any tasks still active when this statement is executed.

ACTIVATE task__specification {,task__specification}

task__specification = line__number [AS__TASK task__number] [PASSING value__list]

task__number = positive non-zero integer not equal to any currently active task number. Used to identify the task.

value__list = numeric__expression {,numeric__expression}

examples:

ACTIVATE 350 *activates the processing of a task beginning at line 350 but assigns no task number to it and passes no values. The task cannot be terminated with a TERMINATE statement which specifies a numbered task.*

ACTIVATE 500 AS__TASK 3 *activates the processing of a task beginning at line 500 and assigns it task number 3. No values are passed. May be terminated by a TERMINATE 3 statement anywhere in any part of the entire program by a TERMINATE within the task itself.*

ACTIVATE 225 AS__TASK 7 PASSING X + 3,SIN(V-H) *activates task number 7 beginning at line 225 and passes two values to the task. Line 225 must be a RECEIVE__VALUES__INTO statement.*

ACTIVATE 350 PASSING CR*L *activates a non-numbered task and passes a single value to it. Line 350 must be a RECEIVE__VALUES__INTO statement.*

TERMINATE [task__number] {,task__number}

examples:

TERMINATE 4,2 *terminates the processing of task number 4 and 2.*

TERMINATE 7 *terminates the processing of task number 7.*

TERMINATE *terminates the task within which the TERMINATE statement appears.*

RECEIVE__VALUES__INTO variable__name {,variable__name}

This statement must appear at the beginning of any task to which values are passed by a value-passing form of the ACTIVATE statement. (OR the beginning of a subroutine called with the PASSING form of GOSUB). It specifies the variables into which the values are passed.

examples:

RECEIVE__VALUES__INTO X

RECEIVE__VALUES__INTO HF, JR, OE

GOSUB line__number [PASSING value__set]

This is a new form of the GOSUB statement which allows values to be explicitly passed to a subroutine. The associated subroutine must have a RECEIVE__VALUE__INTO statement at the specified line number.

examples:

GOSUB 345 PASSING G*5,34.4,FNA(J)

WAIT__FOR logical__expression

examples:

WAIT__FOR X = 7 *halts processing of the task in which this statement appears until the expression X = 7 is true.*

WAIT__FOR (X = 5.3)AND(Z<(SIN(DT))) *logical expression may have any level of complexity.*

SYNCHRONIZE__WITH line__number [IN task__number]

examples:

SYNCHRONIZE__WITH 345 *halts processing of the task in which this statement appears until any other task executes statement number 345.*

SYNCHRONIZE__WITH 850 IN 4 *halts processing of the task in which this statement appears until task number 4 executes statement number 850.*

Table 1 continued from page 33

<p style="text-align: center;">MAXIMUM_NUMBER_OF_TASKS (dummy)</p> <p>returns the integer value indicating the maximum number of tasks which may be active at any given time (as set by the ENABLE_MULTI_TASKING_FOR statement).</p> <p>examples:</p> <pre> LET X = MAXIMUM_NUMBER_OF_TASKS(0) IF (MAXIMUM_NUMBER_OF_TASKS(0) < 7) THEN GOTO 200 LET MAXIMUM_NUMBER_OF_TASKS(0) = 32 </pre> <p>This last example is invalid. Values may not be assigned to this function. It's value is only set by the ENABLE_MULTI_TASKING_FOR statement.</p>
<p style="text-align: center;">NUMBER_OF_ACTIVE_TASKS (dummy)</p> <p>returns the number of tasks which are currently active.</p> <p>examples:</p> <pre> LET ZF = NUMBER_OF_ACTIVE_TASKS(0) IF NUMBER_OF_ACTIVE_TASKS(0) > 6 THEN GOSUB 700 LET NUMBER_OF_ACTIVE_TASKS(0) = 5 </pre> <p>This last example is invalid. This function may not be assigned a value. It assumes a value as tasks are activated and terminated.</p>
<p style="text-align: center;">STATUS_OF_TASK_NUMBER(task_number)</p> <p>returns the status (0 = inactive, 1 = active) of the specified task.</p> <p>examples:</p> <pre> LET ZG = STATUS_OF_TASK_NUMBER(3) IF STATUS_OF_TASK_NUMBER(2) = 0 THEN SO = 4 LET STATUS_OF_TASK_NUMBER(7) = 5 + T </pre> <p>This last example is invalid. Values may not be assigned to this function. It acquires values as the tasks are activated and terminated.</p>
<p style="text-align: center;">TASK_NUMBER_OF_LOGICAL_TASK(logical_task_number)</p> <p>Returns the task number of the specified task number.</p> <p>examples:</p> <pre> LET RO = TASK_NUMBER_OF_LOGICAL_TASK(4) IF TASK_NUMBER_OF_LOGICAL_TASK(9) = 5 THEN GF = 3 LET TASK_NUMBER_OF_LOGICAL_TASK(1) = 5 </pre> <p>The last example is invalid. Values may not be assigned to this function. It assumes values as the tasks are activated and terminated.</p>
<p style="text-align: center;">OK(dummy)</p> <p>This function returns a value indicating whether or not the preceding statement was performed properly. 1 implies that it was OK; 0 implies that it was not. The value of dummy is ignored.</p>
<p style="text-align: center;">!</p> <p>The exclamation mark is appended to variable names to indicate that the variable is a local variable.</p> <p>examples:</p> <pre> FT! J!\$ a local string variable K!% a local integer variable Z!(32) an element of a local array QW!(4,2) an element of a local two-dimensional integer array PZ\$! invalid. The ! must appear before the \$ T%! invalid. The ! must appear before the % SET J! = KH!% + 34.2 RECEIVE_VALUES_INTO_DE!,M! a common use of local variables </pre>
<p>Note: In the above table of statement and function syntax the following conventions are employed:</p> <ol style="list-style-type: none"> 1. Text in all capitals indicates keywords of the multi-tasking BASIC language. 2. Text in lower case (within the syntax definitions) indicate programmer-supplied information such as variable names or expressions. 3. Text enclosed in square brackets indicate optional parts of the statement. 4. Text enclosed in curly brackets indicate optional parts which may appear one or more times. 5. The underscore character, "_", is used to concatenate parts of a phrase which indicate an individual keyword or programmer-supplied name. For example, DISABLE_MULTI_TASKING is a single keyword. 6. Since many versions of BASIC do not allow the underscore characters to appear within names (e.g. RECEIVE_VALUES_INTO) and other versions do not allow keywords longer than 6 characters (or other such restriction) it may be necessary to have alternative keywords for those given here.

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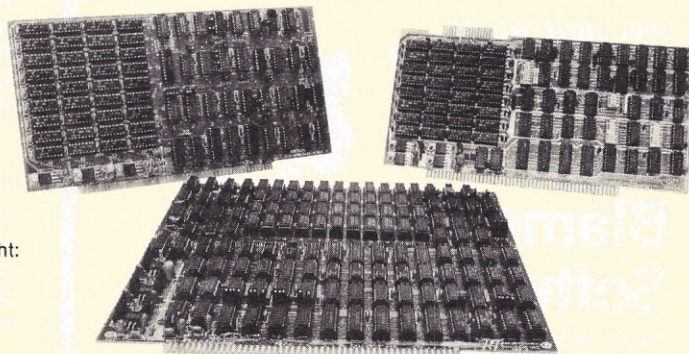
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can be accommodated by the stacks. Essentially it indicates the size of those stacks. The maximum number and size of the stacks is determined by the amount of free memory for the particular computer, exclusive of that required for the interpreter, source program and variables.

Associated with each stack is a set of parameters specifying the status of the stack, the task number associated with the stack, the current source program line number being processed for the task associated with that stack and a pointer indicating the memory location of that program line.

Associated with the entire set of stacks is a set of parameters indicating the stack size (which is the same for all stacks), the maximum number of tasks (these both having been specified by the above ENABLE command), the number of the task currently being processed, and the number of active tasks.

What do we mean by "the task currently being processed"? After all, when we have several active tasks aren't they all being done at the same time? Well, yes and no. Yes, from the programmer's standpoint the tasks are all going on at the same time, and he should program it with that assumption. But in reality we have a computer with only one CPU that can only do one thing at a time, so we are forced to actually do the processing sequentially.

Stimulating concurrent program

We can give the *impression* of concurrent processing (and from the programmer's standpoint that's as good as having actual concurrency) by having the interpreter process a single statement from one task, a single statement from the next task, and a single statement from the next task, and so on in round-robin fashion. This is very similar to the way large scale time-sharing systems operate. Each user thinks he has the whole computer dedicated to his processing alone while in reality it does a little of his program and then a little of someone else's program, eventually getting back to doing a little more of his program again. It does this so fast, however, that he thinks it is only doing his work. In our case, the interpreter sequentially processes each of the tasks so fast that, for all practical purposes, and from each task's standpoint, they are all getting processed concurrently. Hence, one of the parameters that the interpreter must keep track of is the "task currently being processed."

Whenever a task is ACTIVATED the interpreter checks to see if there is an available stack. If not, then a predefined function called OK (see table 1) is set to 0 to indicate a failure in task activation. Otherwise the stack and its associated parameters are initialized. When a task is TERMINATED its stack and parameters are all cleared, allowing them to be used by some subsequent task activation.

Four functions are provided (in addition to those discussed in the previous two columns) which provide access to certain of the stack-related parameters. These are the MAXIMUM_NUMBER_OF_TASKS function that tells how many tasks are currently active at any given point during the running of the program, the STATUS_OF_TASK_NUMBER function that tells whether a specified task is currently active, and the TASK_NUMBER_OF_LOGICAL_TASK function that tells the task number associated with a specified stack. These functions all relate to the parameters shown in the figure and are detailed in table 1, which also provides a summary of all the multi-tasking Basic commands, functions, and features.

Table 2 shows error conditions which may occur during the running of a multi-tasking program. Notice that many of the conditions affect the value of the OK function rather than generating an error message or terminating the program. This allows the program itself to check on whether things are going as expected and to take appropriate error-handling actions should something go awry.

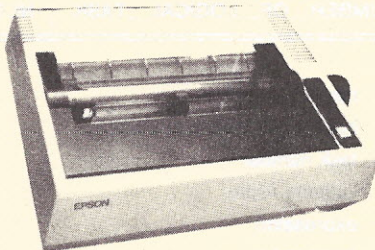
In table 3, we recognize the fact that many Basic interpreters do not allow for function and command names that include the underscore character. The table provides a

Table 2
Multi-Tasking BASIC
Error Conditions

Statement/Function	Possible Error Conditions (E) and Resultant Actions (A)
ENABLE__MULTI__TASKING__FOR	E. Not enough room for the stacks. A. OK(0) set to 0.
DISABLE__MULTI__TASKING	E. One or more tasks still active. A. OK(0) set to 0 ; tasks are not terminated.
ACTIVATE	E. Task__number already used. A. OK(0) is set to 0 ; task not activated. E. No room in set of stacks for another task. A. OK(0) set to 0 ; task not activated.
TERMINATE	E. Specified task not active. A. OK(0) is set to 0.
RECEIVE__VALUES__INTO	E. Invalid variable name. A. Program is terminated.
WAIT__FOR	E. Invalid expression. A. Program is terminated.
SYNCHRONIZE__WITH	E. Line number does not exist. A. Program is terminated.
TASK__NUMBER__OF__LOGICAL__TASK	E. Specified logical task number is greater than the maximum number of allowable tasks (as specified in the ENABLE__MULTI__TASKING__FOR statement). A. OK(0) set to 0 ; - 1 returned by the function.

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possible set of compatible alternatives which should satisfy most existing versions of Basic.

The last feature of multi-tasking Basic we need to address is that of local variables. In last month's column I stated that local variables within a given task are denoted by exclamation marks (e.g. AB!, Q!(3), HJ!\$, are all local variables) and that local variables have the unique feature that two local variables which have the same name but appear in different tasks are actually two different variables. The way the interpreter keeps track of which local variable is associated with which tasks is by keeping not only the name of the variable and the type of the variable (i.e. real, integer, or string) within the

Table 3
Multi-Tasking BASIC
Equivalent Names for Functions and Statements

Since many BASICs have restrictions on the length of names and on the use of the underscore character in names the following list provides equivalent names for those provided in the syntax summary.

Suggested Name	Equivalent Form
ENABLE__MULTI__TASKING__FOR	ETASKS nt,nlr
DISABLE__MULTI__TASKING	DTASKS
ACTIVATE	ACTIV ln[,tn][,vl]
TERMINATE	TERM [tn]{,tn}
RECEIVE__VALUES__INTO	RECEV var{var}
WAIT__FOR	WATFOR exp
SYNCHRONIZE__WITH	SYNCH ln[,tn]
MAXIMUM__NUMBER__OF__TASKS	MNTSK(dummy)
NUMBER__OF__ACTIVE__TAKS	NATSK(dummy)
STATUS__OF__TASK__NUMBER	TSTAT(tn)
TASK__NUMBER__OF__LOGICAL__TASK	NLTASK(tn)

Notes:

- = number of tasks
- nlr = number of levels of return
- tn = task number
- var = variable name
- exp = expression
- ln = line number
- dummy = any value
- vl = value list (i.e. val{,val})

variables table but also keeping the associated task number for those variables which are local to a numbered task. So the variables table might have a variable named GT! associated with task 3 and another variable also named GT! but associated with task 7.

So there we have it. A complete definition of multi-tasking Basic, an implementation plan, a thorough justification for its need, and I hope, an increased awareness by our readers of the multitude of applications, including gaming, robotics, artificial intelligence, process control, and real-time simulation. Only one obstacle now stands in our way: no multi-tasking Basic yet exists. We need some enterprising individual or company to put these concepts into practice, to make multi-tasking Basic available on some widely marketed personal computer, and we will be on our way to the unique and challenging realms of concurrent programming. □



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So if you look at the computer in the picture, you’ll see it says “Taranto” on it, not “TRS-80.” The keyboard and CRT unit are a Tandy II* (that’s what the manufacturer calls TRS-80

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Model II when it’s not sold through the Radio Shack). If it fits your needs better, though, we’ll get the disk drive or the line printer somewhere else.

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Some serious advantages.

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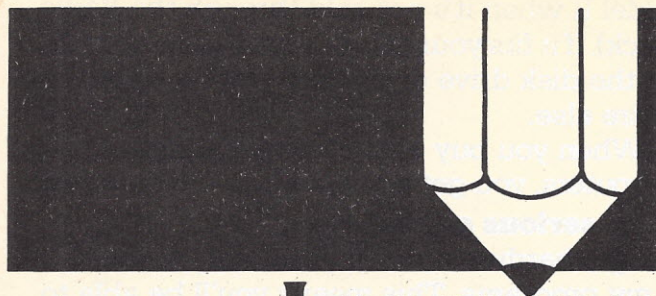
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Learning with Micros

by Louis E. Frenzel

The Microcomputer and the Video Disk

Isn't technology wonderful? Recently it has brought us the fantastic microcomputer. In addition, it has also brought us video recording. Today it is possible to record TV programs on magnetic tape with very low cost video equipment. Just as the computer manufacturers have made the microcomputer affordable by almost everyone, so have the electronic manufacturers made it possible for each of us to own a video cassette recorder (VCR). We are on the threshold of experiencing the video disk. While video disk players are available, technology breakthroughs and a fresh new commitment by industry promises to make the video disk as practical as the common phonograph.

While video disk units cannot record TV programs off the air as their VCR cousins, they are still expected to be popular

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because of their very low cost and the wide availability of disk programs such as movies, musical recordings, and even educational programs. Actually, 1981 should be the year of the video disk. RCA, Zenith, and many others are expected to introduce low cost versions of the popular capacitance format video disk recorder.

The MCA/Magnavox optical video disk unit has been available for well over a year now. But because of its high cost and the lack of sufficient software, it has not achieved the consumer popularity once expected. It is assumed that the new lower cost capacitance system will provide the mass interest necessary to make the disk popular and successful. With powerful retail outlets such as Sears, Radio Shack and others expected to enter the sales arena, the video disk should become a popular home consumer electronic item.

So what are the implications of the video disk for education? And what in the world does the video disk have to do with microcomputers?

We already know the impact that microcomputers have had in education. Microcomputers are becoming more widely used as educational tools, not only to teach computers and programming, but also to teach any subject with computer aided instruction (CAI). Microcomputers are expected to grow in popularity and to become even more widely used in education as their power and usefulness are discovered and harnessed.

It is also no secret that video is one of the most effective learning media available. Schools as well as business and industry use video cassettes to teach many subjects. In fact, next to classroom instruction, video tape is fast becoming the educational standard of business and industry. Virtually any subject can be effectively taught by video techniques.

Is it any wonder then that it has taken so long for someone to discover that the potential of a microcomputer and video tape/disk a combination for education? Thanks again to technology, we have a brand new powerful learning system that combines the benefits and capabilities of both the microcomputers and video.

Whenever you combine a general purpose microcomputer with a video tape or disk unit, you have an extremely effective learning system. Consider if you will a situation where an individual can sit in front of a microcomputer with its keyboard and CRT display connected to a video disk unit with its TV screen. The video disk unit presents a sequence of educational materials on the screen. The microcomputer can display large volumes of text quickly and easily.

Powerful learning combination

With the microcomputer in control, it can sequence the video in a variety of ways and can present text material, ask questions, and otherwise fully automate the learning process. The student responds by answering questions or entering information on the microcomputer keyboard. Because CAI and video have been proven individually to be such powerful learning methods, it is reasonable to expect that the combination of the two will be just as effective if not more so.

Already there has been a significant amount of interest, testing and experimenting with combined microcomputer/video systems for education. The results have been encouraging. In fact, there are several commercial, although expensive, systems in use today for training. The government has awarded a number of grants for the study of just such systems. Overall the results are encouraging, and we all have every right to be excited over the potential for such systems. On the other hand, there is some reason to believe that this powerful combination will never be practical for widespread, general purpose education.

Even though the microcomputer/video disk system is obviously a very powerful and effective educational medium, it will never become widely used. Let's face it, even though we can combine two of the most effective educational tools at our disposal in a new complimentary configuration doesn't necessarily make it practical. The reasons are almost

obvious. Here's why this combination will never be widely used for education:

1. **Cost.** Both microcomputers and video tape/disk units are still relatively expensive. Even though both have declined in cost over the years, they still represent a sizeable investment for schools, companies and individuals. While lower cost has greatly increased the use of both the micro and video tape/disk units, costs are still a major deterrent to their use.

Most schools are still struggling to find funds for either computer or video equipment. Even industry resists despite its ability to afford. After all, there are other more inexpensive ways of learning. The popular classroom lecture and the ubiquitous textbook are still tremendously effective and low in cost. They will continue to dominate all levels of education.

2. **Lack of Software.** While many organizations and institutions may be able to afford a microcomputer/video disk system, the lack of software if nothing else will make the

**Even though the
microcomputer/video disk
system is a powerful
educational medium,
it will never become
widely used.**

combination unuseable. Where will the software come from? Who will develop it? Who will supply it?

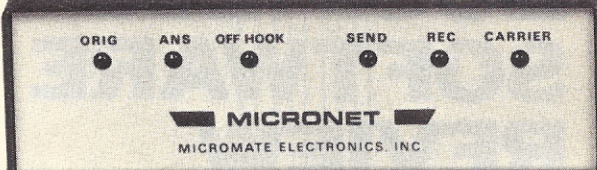
Just think for a minute of the software required for such a system. It takes a program for the microcomputer and, of course, a video disk or disk containing the video keyed to the microcomputer program. What we actually have is a combination of CAI and a video learning program. The two are obviously interrelated and interactive. And what about the various computer/video formats required (i.e., TRS-80/Beta, Apple/VHS, etc.)? What about disk mastering costs?

3. **Lack of Software Development Sources.** Who is going to develop the software for the micro/disk learning systems? It is obviously difficult enough to create a CAI program for a microcomputer. It is also quite difficult and challenging to develop an effective video education program. Different skills are required to develop the two types of materials. A rare combination of technical knowledge, programming and educational expertise is necessary in an individual to create a complete CAI/video course.

Obviously there are few people who can develop such programs alone. And if such individuals cannot be found, it will be necessary to train teams of development people. The difficulty of assembling the necessary talent and the high cost of development will make the resulting programs so costly as to make them virtually impractical. Are computer or video equipment manufacturers willing to support such development? What about traditional publishers (McGraw-Hill, etc.)? I think not.

The microcomputer/video disk combination is an exciting new development. We should study it, investigate it and prove its effectiveness and viability. We should even look for ways to make it practical. However, it is unfortunate that the realities of education will make this system totally impractical and unusable. Just because we can do something technically doesn't necessarily make it realistic or useable. Maybe this combination will find limited usage (the military?), but don't expect to see one in your school, your company or your home in the near future. □

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BUSINESS SOFTWARE REVIEW

By Carl Heintz, CPA

Software for the Stock Market: Stockpack by Standard & Poors

Most of us have heard stories about investors using their home computers to make incredible profits in the stock market. Recently, an engineer reportedly netted about \$50,000 a year with his Apple. He had his wife, children, and neighborhood kids input opening and closing stock prices, which his computer analyzed and refined into buy and sell orders.

If you own a TRS-80, you don't have to input for hours on end with the software reviewed here. But there is no guarantee that it will generate \$50,000 a year. The authors give the buyer the tools: it is up to him to develop a system.

Stockpack is a portfolio management system produced under the auspices of Standard & Poors and distributed by Radio Shack for TRS-80 models I or II. The system has two functional aspects—a stock “management” system, which keeps track of a portfolio of investments, and a stock “selection” system, which allows an investor to scan 900 companies on a monthly updated data base to choose stocks to buy or sell. Stockpack is available at local Radio Shack stores for about \$50. Subscription to Stockpack data base (necessary for full utilization of the system) costs about \$200 per year.

Stockpack is a neatly produced package with four diskettes (TRS-80 model I version). The system requires at least 32K of memory and two disk drives. A line printer is not required, but strongly recommended. It requires absolutely no previous computer experience, so is ideally suited as a first business application.

The programs allow the user to accomplish the following record keeping and analysis functions:

- Manage a portfolio of up to 100 securities with up to 30 transactions in each security
- Scan and analyze the Stockpack data base which contains 900 companies according to user criteria
- Provide eight predefined reports
- Up to 50 user-defined reports can be stored in a library
- Create a data base as a subset of S&P's data base or user entered data

Key to the successful implementation of the system is the data base, and the analytical tools that can be applied to it. The data base contains the S&P 500 (which correspond roughly to the fortune 500), 250 other companies followed by S&P analysts, and 150 actively traded issues on the New York, American or over the counter markets. The data base is updated monthly, and a subscription costs \$200 per year, or about \$17 per diskette. Each diskette is crammed full of data:

General: ticker symbol, industry classification, exchange upon which traded, S&P earnings and dividend rank

Earnings-per-share data: for 1976, 1977, 1978, and 1979 if available, EPS for last 12 months, five year EPS growth rate, an EPS footnote

Net sales and net income: the latest available, % changes and fiscal year-end information

Stock prices: current, year end, high and low

Balance sheet: cash, current assets, liabilities, long term debt, book value per share, number of common shares outstanding

Volume for the month: number of shares traded

Dividend information: ex-dividend data and current indicated dividend rate

Assume that a user has purchased Stockpack and desires to view the data base. The first step is to select the stocks. S&P has provided the user with 10 selection formats ready to use. Others must be formatted by the user. The selection schemes are varied, including such criteria as price earnings ratios, stocks selling below book value, stocks ranked A or better, companies with a five year growth rate, stocks selling 50% or more below the last year's high, companies which have increased earnings 20% or more in the last year, companies with a current ratio of better than 2 to 1, and companies in the oil and gas industry meeting certain criteria.

Appendices fully describe the screens and the contents of the reports. In the case of the selection criteria, an appendix even gives approximate runtime. This is very helpful in reducing anxiety, since sorts and selection procedures inevitably take longer than the user expects.

The computer will do the selection indicated and then ask for further instructions. The user has the option of listing companies which met the criteria, those which did not, or taking those which met the criteria and running another set of criteria against them. Thus it is possible to have multiple sorts and selection procedures with a multi-tiered selection procedure.

Once stocks have been selected, the user can print a report. S&P supplies 20 report formats, which, in all but the most demanding situations should satisfy the investor's needs. Reports can be printed or viewed on the screen. Additionally, the reports can be sorted according to any item contained in the report.

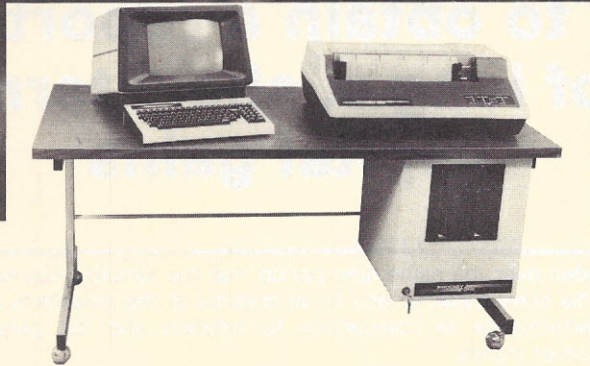
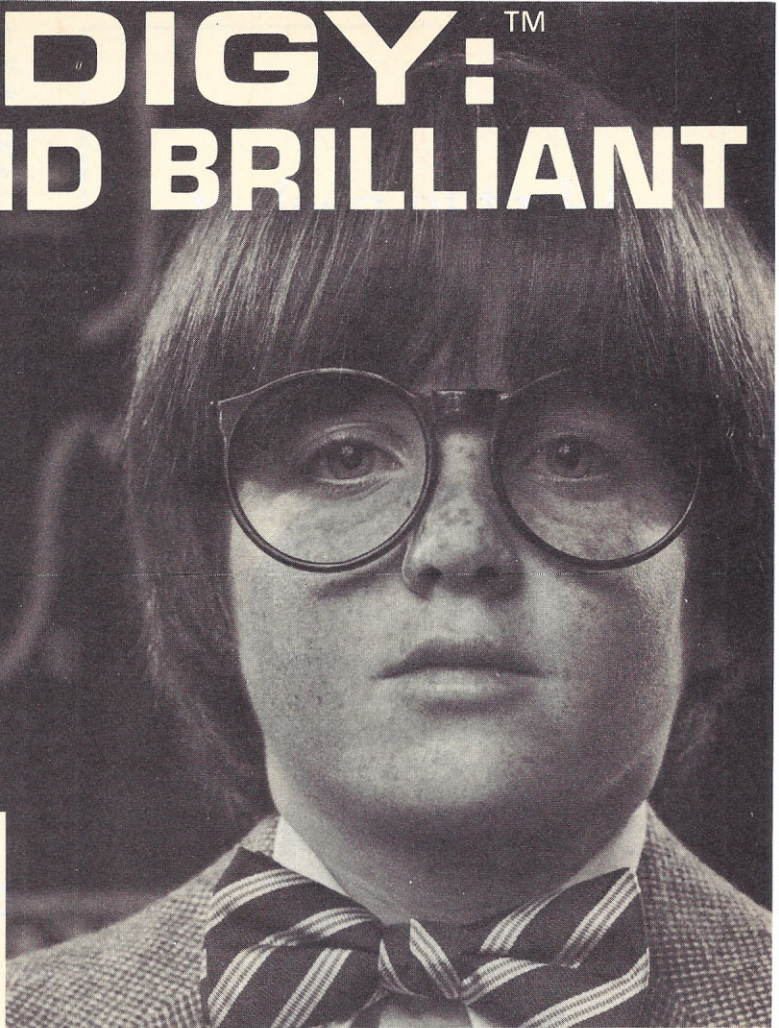
The programs maintain all records required to effectively manage a stock portfolio, including buy and sell transactions, stock and cash dividends, and stock splits. There are eight predefined reports that can be shown on the screen:

- Name, ticker symbol
- Current price, price/earnings ratio
- S&P index, rank
- Dividend rate, ex-dividend date, dividends received
- Number of shares held
- Cost, commissions paid
- Current value, realized gains/losses, unrealized gains/losses
- Trade dates

The system accounts for purchases of stock on a “lot” basis, which means that individual purchases and sales can be coordinated. In stock record keeping, this is important, especially for tax purposes since, although an investor may have an overall profit in a stock (say he bought it at an average price of \$8 and it's now at \$11), there may be gains and losses. To sell the loss portion, and recognize the loss for taxes is important. In the example above, the average price of \$8 might be made up of 100 shares at \$12 and 100 shares at \$4. Obviously, if the investor wants a tax loss, he should sell at \$12, recognizing a one point loss.

The system has a beautiful portfolio summary which clearly and completely identifies an investor's position in any particular security, giving information on the purchases, sales, dividends, stock dividends, and stock splits. In the case of stock dividends, the stock received is treated almost like a purchase, with a notation that it represents a stock dividend. The “price” for the stock is shown as the average adjusted purchase price.

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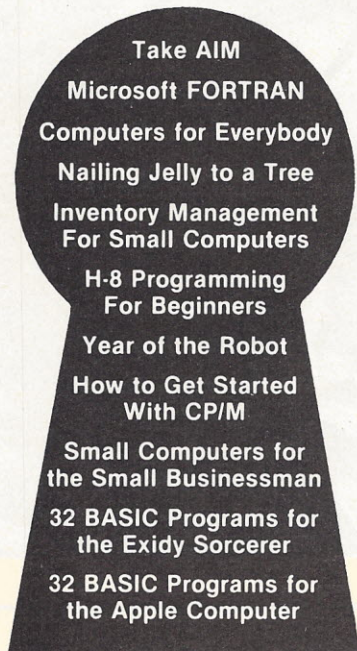
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The system correctly shows no added value to the security portfolio. Stock splits are similarly correctly handled as an additional security, noted by a split, with the average "cost" for the security calculated and displayed. The system does not alter the cost price of the original security purchased, however, leaving that to the user.

The system properly assigns no value to a stock split (in other words, for tax purposes, the system works the right way in its handling of stock splits and stock dividends). The system will calculate the number of shares to be received in a stock split with the user merely entering the ratio (such as 2 for 1).

The true power of the Stockpack comes, however, when the computer is used to summarize the performance of the holdings. There is a "net position report" that may be presented according to alphabetical listing, current value, gains and losses. The system will calculate unrealized gains and losses when the portfolio is updated with current price information.

Additionally, the rate of return can be displayed for all portfolio holdings. The rate of return also gives an indication of the relative performance of a security compared to the S&P

Portfolio reports allow the investor to obtain a report of long v. short term capital gains

index over the same time period that the security was held. This comparison is vital to an analysis of the investor's real performance in comparison to inflation and the general market trends.

For tax planning, the portfolio reports allow the investor to obtain a report of long versus short term capital gains. The reports are so well documented and laid out that an investor can submit them in lieu of the IRS forms with his tax return.

In addition to "realized" capital gains and losses, the report function allows an investor to do tax planning by presentation of an "unrealized" gain/loss report summarized at any point in time.

Most sophisticated investors have pet methods of selecting investments. Stockpack can accommodate them with the ability to define and store algorithms for stock selection. No programming is required; however an understanding of simple algebra is mandatory.

For most common stock investors, the Stockpack programs are ideal. One should be aware that there are some elements missing, most notably provisions for bonds. A user can account for bonds in the system, although somewhat awkwardly. Prices must be updated manually.

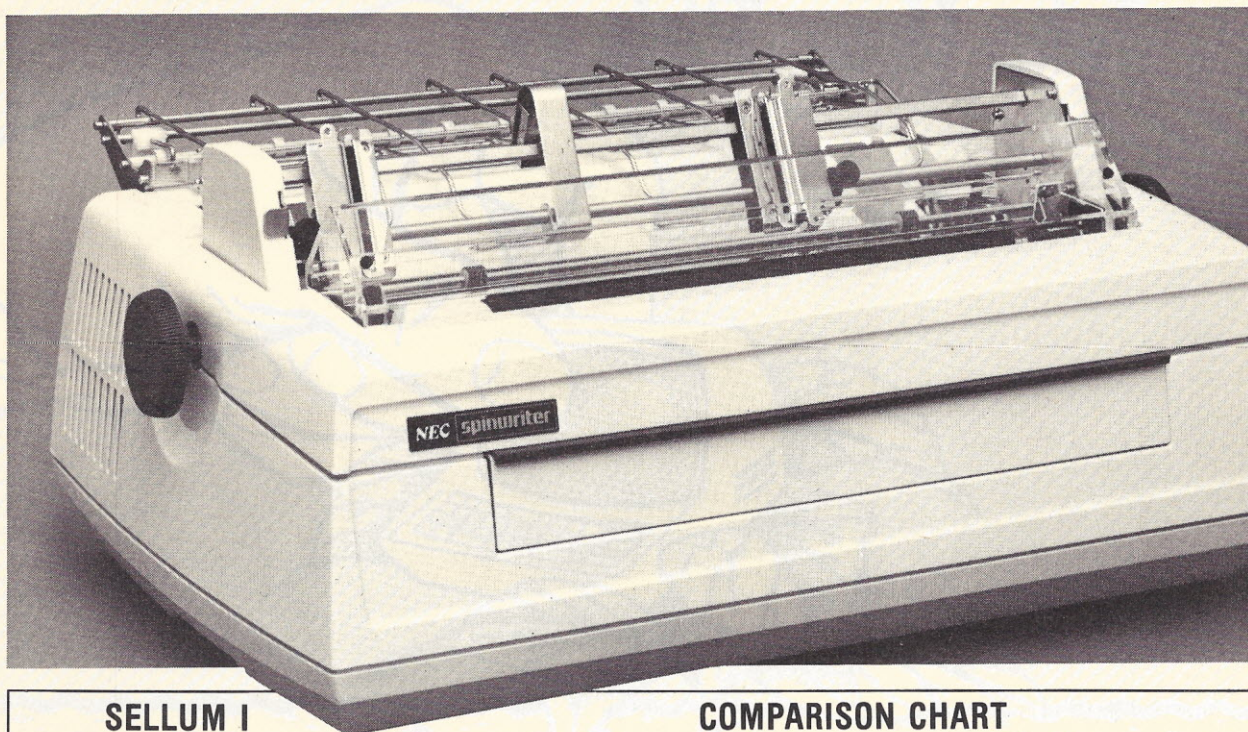
Another missing element is accounting for options purchased or sold. Options are an important part of a portfolio, and the necessity of accounting for them is as important as the security of purchase. For example, the expiration date, call or put price, etc., are necessary and timely elements for the options trader.

A creative entrepreneur could come up with a method of patching these programs into a WATS line for day-to-day update: a feature that would multiply usefulness ten-fold.

These deficiencies are not serious to the programs' overall usefulness. The management system alone justifies the price. My recommendation: a strong "buy." □

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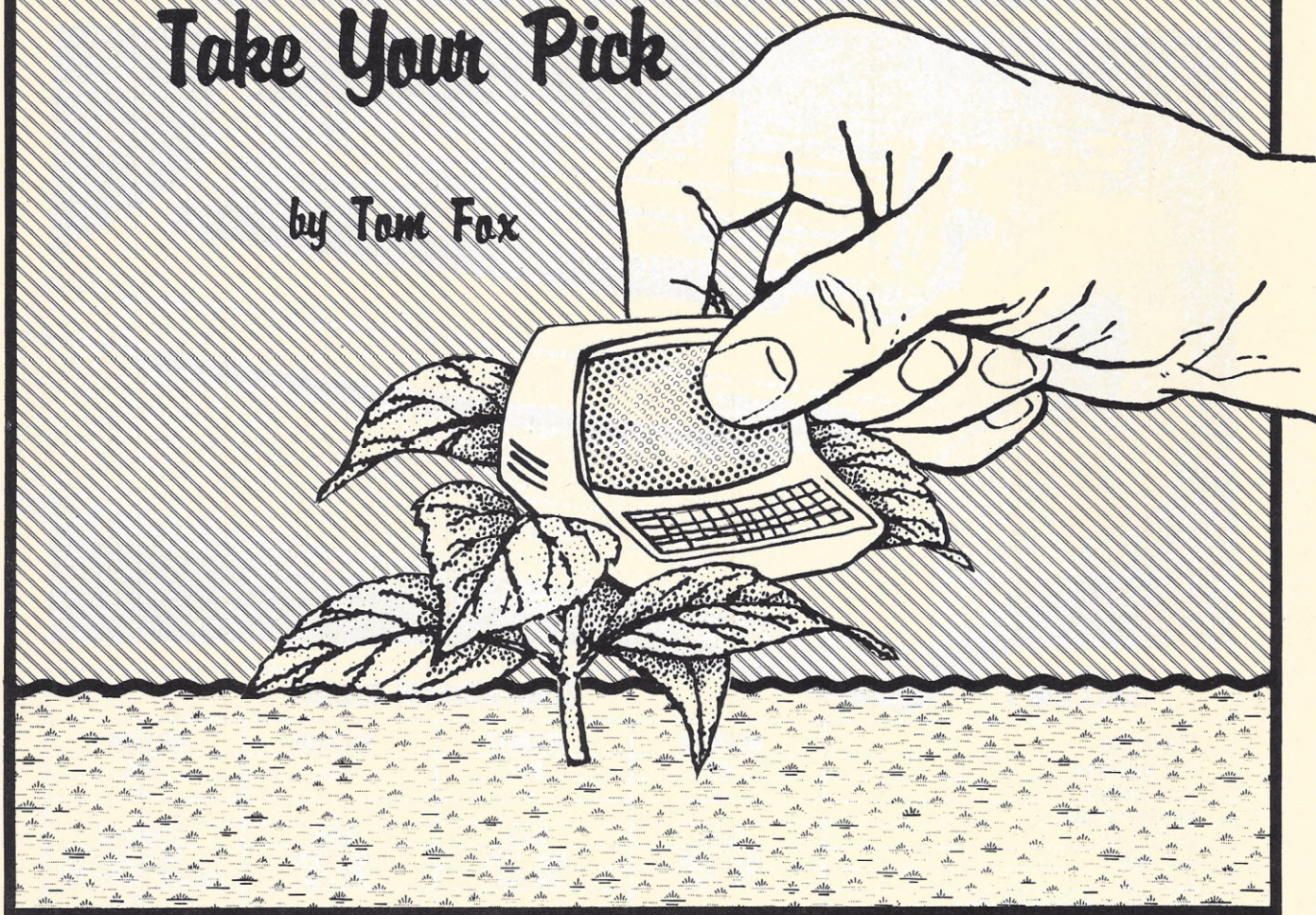
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Personal Computers— Take Your Pick

by Tom Fox



The accompanying charts list the pertinent specifications for this year's crop of personal computers. Study them closely and you'll see how different the various manufacturers define the concept "computer." At the heart of each machine beats a microprocessor chip, the spaceage invention which makes these devices affordable for many families. Beyond this, however, we see a dizzying array of shapes, sizes and features.

Low cost is the name of the game in this class of computer, and picking a good one is largely a matter of finding the manufacturer who has made the fewest sacrifices at the altar of economy. The most common money-saving trick is to depend upon the purchaser's television set as the output device for the processor.

This is accomplished by including a radio-frequency (RF) modulator within the computer. The device converts patterns of numbers, letters and graphics displays into a modulated RF signal which feeds directly into the antenna terminals of a TV set. Most units allow a selection of VHF channels 3 and 4, one of which is free of broadcast traffic in most cities in the United States. Actually, all of the computers are provided with a TV/computer selector switch which prohibits the TV set from performing both duties at once. Its main purpose is to keep the computer from radiating its signal into your neighbors' homes via the roof-top antenna.

RF radiation—even the micro-power, nonhazardous kind emitted by computers—is a real concern to the Federal Communications Commission. As a result, all devices which connect in this manner to TV sets must be approved by it. Look for the FCC certification label before you take delivery on any home computer or TV game.

The first chart gives general information about each computer, as well as details of the microprocessor central processing unit (CPU), memory and Basic language implementation. The chart also shows the expected time when some of the newer units will go into production; not all are available at this moment.

Perhaps the most important entry in this chart is the price column. With but a single exception, we have selected the "minimum" configuration which can be operated as a stand-alone computer, and which will allow the user to write and execute programs in Basic. (In order to provide a fair comparison, we have added in a \$50 allowance for an accessory RF modulator in the Apple and Ohio Scientific units.) The rest of the chart entries indicate the capabilities—hardware and software—included in this price.

Random access memory (RAM) and read-only memory (ROM) sizes are shown in bytes—computerese for characters. "K" means kilobytes, not exactly the

same as thousands of bytes. One kilobyte (1 Kbyte) is equal to 1,024 bytes or characters. "Usable" RAM on this chart indicates the amount of memory available after the Basic language and various other necessary programs are loaded in.

Special operations possible

The Basic "vocabulary" is the total number of instructions, commands, and logical operators that are honored in the language. The higher the number, the more capable is that particular implementation. Some of the computers have enhanced abilities by use of PEEK and POKE commands, which open the door to special operations which aren't possible via Basic commands alone.

The Basic "speed" is the number of seconds required to execute our prime number cruncher benchmark program (IA Jun 80). Our staff and readers have run this program on well over a hundred different processors, from programmable calculators to megabuck mainframes.

Although it tests but a few of the many capabilities of a modern computer, we find it to be a satisfying rough assessment of a computer's horsepower. Note that there is only an approximate correlation between this benchmark performance and the actual microprocessor speed, which is given in megahertz (or millions of processing cycles per second).

The second chart delves more deeply into the selection of personal computers. It shows details of the essential input and output (I/O) operations of the processing devices. Inputs take the form of keyboard entry, hand controls, light pens, telephone line connection and cassette or floppy diskette mass storage.

Outputs are the display screen (usually with separate character and graphics modes), sounds, printer, telephone line and tape cassette or floppy diskette. Without these critical I/O capabilities, any computer is a blind, dumb and mute entity, unable to accept problems or communicate the answers to the outside world.

Sophisticated display features

Most personal computers have multicolor display capability, a feature which puts them ahead of all but a few of the much more expensive business class computers. Graphics capabilities, too, are well advanced in several of these inexpensive units. The machines which utilize monitors for output (instead of RF modulators in concert with your TV set) enjoy a dramatic superiority in usable resolution and picture quality.

Some computers, such as Texas Instruments' TI-99/4 and Ohio Scientific's C1P Series 2, are available with extra-cost monitors. The investment may not be bad if heavy use is anticipated for the computer—scheduling conflicts with a single TV set can become a leading cause of interpersonal stress in some of today's families.

Keyboards come in three styles. "Full stroke" is the big-computer kind of keyboard. It is full-size and has the feel of much more expensive equipment. The other extreme is the "diaphragm" keyboard. This takes the form of a single thin sheet of metal with raised bubbles, which collapse with a snap under finger pressure. Although a real money-saver, diaphragm keys are

usually a barrier to smooth and rapid data entry—particularly those which have been miniaturized to less than human finger spacing.

"Calculator" style keyboards fall midway between the full stroke and diaphragm designs. They have the feel and limited stroke of the keys used on pocket calculators. They usually provide an acceptable compromise between the conflicting goals of economy and finger comfort.

The ability to generate complex musical sounds is another area in which these home computers are far superior to expensive number crunchers in the business and scientific class. Capabilities range from a single short "beep" to multipart tones in variable frequencies that exceed the ability of the human ear to appreciate.

The most common mass storage device in personal computers is the ubiquitous audio cassette recorder. From a legacy of cranky operating procedures and a penchant for garbling critical program data, these inexpensive devices have matured into viable, if still very slow, means to save programs between computer operating sessions. A great many format standards exist, however. This means that interchanging programs via cassette between different brands of computers is possible in only a few lucky circumstances.

Several of the computers can be purchased with optional floppy diskette drives, a far superior way to store programs and data. The cost of these accessories gives pause, however, since they can easily exceed the initial cost of the computer itself. This does not mean that floppy drives are particularly costly. It highlights the fact that home computers have become very inexpensive in recent years.

Listed under peripheral devices are the most common of those accessories which can greatly enhance the usability of a personal computer. Hand controls include joysticks, game paddles, and pistol grips—some of them with a calculator-style keyboard for more complex information entry. They are primarily utilized for game programs, but may serve as inputs for graphics entry and music composition as well.

A light pen is a tool for pointing directly at the screen and have the computer understand which part of the display you are indicating. Printers are more useful in a business environment than a home, but provide invaluable printout listings to ease the inevitable task of program debugging.

Modem is short for modulator/demodulator, a device which allows the computer to be connected to a telephone line. This opens up vast areas for exploration, as it gives access to a mushrooming array of public bases and information interchange networks. It also allows you—for an hourly fee—to tap into more powerful time-sharing computers if your processing needs exceed the capabilities of the personal computer. Serial I/O is a catch-all that allows the connection of a variety of additional machinery to the computer. For example, it is the means utilized for some of the units to connect to external printers and modems.

Incidentally, a "none" entry in the peripheral devices box means only that the computer manufacturer doesn't list such an item in its catalog. In many cases, accessories with differing brand names are available for connection to your machine. □

Charts follow

Personal Systems Data

Manufacturer	Computer	Basic Price	Size (H x W x D)	Manuals		Available	Microprocessor			RAM (bytes)			ROM (bytes)		BASIC Language		
				Books	Pages		Device	Bits	Speed	Standard		Maximum	Standard	Maximum	Vocab- ulary	Floating point	Speed (sec)
										Total	Usable						
APF Electronics, Inc. 1501 Broadway New York, NY 10036	Imagination Machine	\$399.00	6" x 19" x 17"	2	42	Now	6800	8	0.9 MHz	9K	8,000	17K	14K	14K	38	Yes	7950
Apple Computer Inc. 10620 Bandle Dr. Cupertino, CA 95104	Apple II +	\$1380.00	4.5" x 15" x 18"	4	470	Now	6502	8	1.0 MHz	16K	14,336	64K	16K	16K	80	Yes	960
Astrovision 6460 Busch Blvd. Columbus, OH 43229	Bally Arcade	NA	8" x 16" x 20"	NA	NA	Mid-1981	Z80	8	1.8 MHz	32K	NA	64K	24K	NA	NA	Yes	NA
Atari 1265 Borregas Ave. Sunnyvale, CA 94086	400	\$499.95	4.5" x 11.5" x 13.5"	2	NA	Now	6502	8	1.8 MHz	8K	NA	16K	10K	NA	NA	Yes	NA
Casio Inc. 15 Gardner Rd. Fairfield, NJ 07006	FX-9000P	NA	8" x 18" x 19"	NA	NA	3rd quarter 1981	NA	NA	2.7 MHz	4K	4,000	32K	12K	16K	NA	Yes	NA
Commodore 761 5th Ave. King of Prussia, PA 19406	VIC 20	\$299.95	3" x 16" x 7"	NA	NA	2nd quarter 1981	6502	8	NA	5K	3,686	32K	None	27K	NA	Yes	NA
Exidy Systems, Inc. 1234 Elco Dr. Sunnyvale, CA 94086	Sorcerer II	\$2500.00	3" x 19" x 10"	NA	NA	Now	Z80	8	2.0 MHz	32K	32,000	48K	16K	48K	67	Yes	NA
Intelligent Systems Corp. 225 Technology Park Norcross, GA 30092	Intecolor 3651	\$2945.00	14" x 20" x 27"	3	262	Now	8080A	8	1.0 MHz	16K	15,665	32K	16K	24K	66	Yes	1269
Mattel Inc. 5150 Rosecrans Ave. Hawthorne, CA 90250	Intellivision	NA	4" x 21" x 20"	NA	NA	Mid-1981	NA	16	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ohio Scientific 1333 S. Chillicothe Aurora, OH 44202	C1P Series 2	\$529.00	5" x 15" x 20"	1	152	Now	6502	8	1.0 MHz	8K	8,000	32K	10K	10K	50	Yes	1431
Radio Shack 1800 One Tandy Center Fort Worth, TX 76102	TRS-80 Color Computer	\$399.00	4" x 15" x 14"	3	346	Now	6809E	8	0.9 MHz	4K	2,343	16K	8K	16K	65	Yes	1457
Rockwell International P.O. Box 3669 Anaheim, CA 92803	AIM 65	\$610.00	5" x 14" x 17"	7	610	Now	6502	8	2.0 MHz	1K	1,000	48K	16K	16K	57	Yes	1001
Sinclair Research 50 Staniford St. Boston, MA 02114	ZX80	\$199.95	1.5" x 7" x 8.5"	1	128	Now	Z80A	8	3.2 MHz	1K	1,000	16K	4K	16K	34	No	1631
Texas Instruments P.O. Box 10508 Lubbock, TX 79408	TI-99/4	\$699.90	3" x 15" x 10"	4	372	Now	TMS- 9900	16	3.0 MHz	16K	15,284	32K	26K	56K	70	Yes	2480
United Chem-con Corp. 2950 Old Tree Dr. Lancaster, PA 17603	Cyber Vision 2001	\$329.00	4" x 21" x 11.5"	2	86	Now	1802	8	2.5 MHz	2K	1,753	32K	1K	1K	22	No	NA

Computer	Display				Keyboard		Sound		Mass Storage				Peripheral Devices				
									Cassette Tape Recorder	Floppy (bytes)		Speed (char /sec)					
	Type	Colors	Chars	Graphics	Type	Keys	Range	Parts		Standard	Maximum		Serial I/O	MODEM	Printer	Light Pen	Hand Controls
APF Imagination Machine	Your TV	8	16 × 32 = 512	256 × 192 = 49,152	Full stroke	49	3 octaves	1	Included	None	140K	120	Optional	Optional	Optional	None	Included
Apple Apple II +	Your TV	15	24 × 40 = 960	193 × 280 = 54,040	Full stroke	51	4 octaves	1	Yours	None	560K	NA	Optional	None	Optional	None	None
Astrovision Bally Arcade	Your TV	256	NA	160 × 100 = 16,000	Full stroke	59	3 octaves	3	Optional	None	NA	180	Included	None	Optional	Optional	Included
Atari 400	Your TV	16	24 × 40 = 960	160 × 96 = 15,360	Diaphragm	61	4 octaves	4	Optional	None	700K	60	Included	Optional	Optional	Optional	Optional
Casio FX-9000P	B & W monitor	2	16 × 32 = 512	256 × 128 = 32,768	Calculator	67	NA	NA	Optional	None	NA	NA	Optional	None	Optional	None	None
Commodore VIC 20	Your TV	16	23 × 22 = 506	176 × 176 = 30,967	Full stroke	66	3 octaves	3	Optional	None	NA	NA	Included	None	Optional	Optional	Optional
Exidy Sorcerer II	B & W monitor	2	30 × 65 = 1950	512 × 240 = 123,880	Full stroke	60	1 freq.	1	Yours	None	1000K	120	Included	Optional	Included	None	None
Intelligent Systems Intecolor 3651	Color monitor	8	32 × 64 = 2048	128 × 128 = 16,384	Full stroke	73	1 freq.	1	None	90K	180K	12500	Included	None	Optional	Optional	None
Mattel Intellivision	Your TV	NA	NA	NA	Full stroke	60	NA	NA	Included	None	None	NA	NA	None	None	None	Included
Ohio Scientific C1P Series 2	Your TV	2	24 × 24 = 576	256 × 256 = 65,536	Full stroke	53	6 octaves	3	Yours	None	180K	30	Included	Optional	Optional	None	Optional
Radio Shack TRS-80 Color	Your TV	9	16 × 32 = 512	128 × 64 = 8,192	Calculator	53	255 freqs.	1	Optional	None	None	150	Included	Optional	Optional	None	Optional
Rockwell AIM 65	LED display	2	1 × 20 = 20	16 × 20 = 320	Full stroke	54	None	None	Yours	None	None	NA	Included	Optional	Included	None	None
Sinclair ZX80	Your TV	2	22 × 32 = 704	44 × 64 = 2,816	Diaphragm	40	None	None	Yours	None	None	NA	None	None	None	None	None
Texas Instruments TI-99/4	Your TV	16	24 × 48 = 1152	192 × 384 = 73,728	Calculator	41	8 octaves	3	Yours	None	270K	60	Optional	Optional	Optional	None	Optional
United Chem-con Cyber Vision 2001	Your TV	8	16 × 40 = 640	128 × 96 = 12,288	Diaphragm	40	256 freqs.	1	Included	None	None	200	None	None	None	None	Included

Sounds of the Atari

...in Basic

Part II Color Graphics

by Herb Moore ©

Atari graphics are easy to work with and quite enjoyable. There are three commands necessary to activate them. First a graphics mode. There are a number of different graphics modes with different things to offer. But to get things going, start with mode 3. This would be entered:

```
10 GRAPHICS 3
```

or

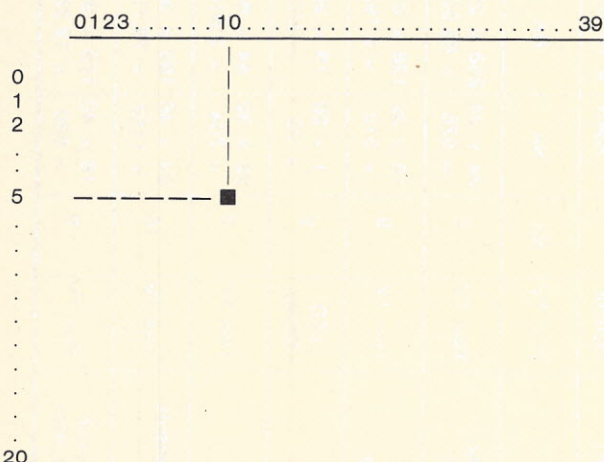
```
10 GR. 3
```

The abbreviated version must have the period. If you list a program in which you've entered the abbreviated form, the machine will spell out the entire word 'graphics'.

The next command you need is 'color'. There are 16 colors available in Atari Basic (numbered 0-15), which we will soon see. For now, use 'color 1' as follows:

```
20 COLOR 1
```

Finally we need to plot at least one point. In graphics mode 3, there are 40 columns and 20 rows of points from which to choose, starting with 0,0 in the upper left corner of the screen. The diagram shows a point that has been plotted in column 10, row 5.



A command to plot this point takes the form:

```
30 PLOT 10,5
```

The number of the column is first, followed by a

comma and then the number of the row. The program looks like this:

```
10 GRAPHICS 3
20 COLOR 1
30 PLOT 10,5
```

Running the program should give you a dot in the upper left quadrant of the screen. Note that there is an area at the bottom of the screen divided off from the rest of the display. This is the text window where the cursor and the word 'ready' will appear. If your sense of esthetics happens to be offended by the word 'ready' on the screen, you can get rid of it with the command:

```
40 GOTO 40
```

This causes the machine to wait at line 40 until the 'break' or 'reset' key is pressed. The text window allows up to four lines of printed material to be added to the screen. If you haven't used a 'print' command in Basic, here's how it works.

```
35 PRINT "I HAVE MADE MY POINT"
```

The machine will print on the screen whatever is between the quotation marks. Normally it would just be printed on the blank screen, but if we enter this line into the program we have so far, it will appear in the text window. The machine will not print the quotation marks; if you want to indicate a quote, enter something like:

```
35 PRINT "'THIS IS A QUOTE'"
```

This ability to include printed material with the graphics can be quite useful for presenting instructional material.

The values for points to be plotted can also be variables. Here's an example of how a 'for-next' loop can be used to plot a series of dots across the screen. This program will plot points in each of seven different columns (5,10,15.....35), always in row 5.

```
10 GRAPHICS 3
20 COLOR 1
30 FOR X=5 TO 35 STEP 5
40 Y=5
50 PLOT X,Y
60 NEXT X
```

The plotting of each consecutive point can be emphasized by adding a time delay loop at line 55:

```
55 FOR T=1 TO 200: NEXT T
```


This will cause the dots to blink onto the screen, one after the other, going across.

It is also possible to perform mathematical operations on a variable. Since we only have 20 rows available in this graphics mode, we can plot a series of dots descending in a diagonal from the upper left corner of the screen by using the value $Y = X/2$ in line 40 of the above program. Line 40 looks like:

```
40 Y = X/2
```

From this point in the program, it is fairly easy to add some sound that will be coordinated with the points plotted.

But first, there is one more bit of information you'll need to know: rather than the standard multiplication sign, use an asterisk * to multiply in Atari Basic. Enter a value for the variable NO as follows:

```
60 NO = 5*X
70 SOUND 0,NO,10,10
80 FOR T = 1 TO 200: NEXT T
90 NEXT X
```

Line 80 is a time delay loop that gives the note some duration rather than quickly turning on and off again.

Note that the 'for-next' loop beginning at line 30 is not completed until line 90. In that way, all of the various operations called for are executed before the next value of X is entered. Adding line 100:

```
100 GOTO 100
```

will get rid of the word 'ready' in the text window, but the last tone will be sustained. It can be turned off by entering a command such as:

```
100 SOUND 0,0,0,0
```

Then add:

```
110 GOTO 110
```

and it should play and plot the seven notes and leave the text window blank.

By now the program listing should look like this:

```
10 GRAPHICS 3
20 COLOR 1
30 FOR X=5 TO 35 STEP 5
40 Y=5
50 PLOT X,Y
55 FOR T=1 TO 200: NEXT T
60 NEXT X
70 GOTO 70
```

Consider what to do in order to have the dots move in the direction of conventional music notation. That is from left to right across the screen, and higher or lower for higher and lower pitches. In that case, the sequence of tones in our present program should coincide with a diagonal of dots starting at the lower left corner and moving to the upper right.

Remember that the lowest notes are represented by the highest numeric values in Atari Basic. To play a sequence ascending in pitch, we need to have a line like:

```
30 FOR N=35 TO 5 STEP -5
```

We also have to change the X in line 60 to an N, giving:

```
60 NO = 5*N
```

Since the higher the value of Y, the lower the row will be on the screen, so it can vary in direction proportional to the value of N. That is, the higher the numeric value, the lower the note and the further toward the bottom of

the screen it will appear. In order to stay within the limit of 20 rows, line 40 can become:

```
40 Y = N/2
```

For the value of X, however, we want it to increase as each point is plotted in order to move from columns 0-39 going from left to right on the screen. But the value of N is decreasing in line 30, so we enter line

```
45 X = 39 - N
```

Thus, when N = 35, X = 4
when N = 30, X = 9

and so on....

Now change line 90 to

```
90 NEXT N
```

to complete the 'for-next' loop begun in line 30. Here's a listing after those changes. If run now, it should plot the points in a diagonal going from the lower left corner to the upper right corner of the screen as the notes increase in pitch.

```
10 GRAPHICS 3
20 COLOR 1
30 FOR N=35 TO 5 STEP -5
40 Y = N/2
45 X = 39 - N
50 PLOT X,Y
60 NO = 5*N
70 SOUND 0,NO,10,10
80 FOR T = 1 TO 200: NEXT T
90 NEXT N
100 SOUND 0,0,0,0
110 GOTO 110
```

Sticking with the color graphics a bit, use another 'for-next' loop and enter the variable C for color. This can be done by adding:

```
15 FOR C=0 TO 15
100 NEXT C
```

and changing line 20 to:

```
20 COLOR C
```

Now you should get different colored dots each time the sequence is played. If you run this program, note that some of the values for C will erase the dots rather than enter a new color. This affords the possibility of creating a figure on the screen, and then erasing it before another figure is drawn.

Only a few colors will repeat themselves as the sequence is played. You can expand the variety of colors by adding a further command. This is a little tricky, so hang in there. For the sake of illustration, enter a 'setcolor' command, which has three variables:

```
25 SETCOLOR 0,6,8
```

(registration) (hue) (luminance)

There are 15 hues available (from 0-15). To see them, change line 20 to

```
20 COLOR 1
```

and make 25:

```
25 SETCOLOR 0,C,8
```

Now you should see quite a variety of colors for the dots.

Luminance varies the amount of white in the color. It must be an even number between 0 and 14. If you put the hue at 6 (purple) and let the luminance be the variable C as follows:

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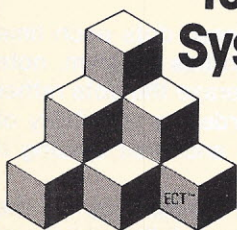
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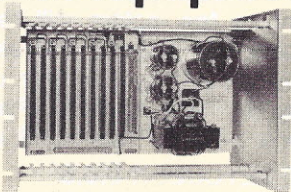
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25 SETCOLOR 0,6,C

it will come up a very dark purple and become lighter every other time through the cycle. It only changes every other time because it requires even numbered values.

Finally, try leaving the luminance at 8 and entering:

25 SETCOLOR C/4,6,8

since the color register only accepts values from 0-4. When I tried this, first the dots, then the text window, and finally the whole screen turned purple. The color register acts differently depending on the graphics mode. The following chart shows the number of columns and rows in each mode.

Graphics Mode	Number of Rows	Number of Columns
3	20	40
4,5	40	80
6,7	80	160

By adding 16 to one of these, you obtain a graphics mode with the same number of columns and rows, but no text window.

By now you should have a pretty good start on some of the color parameters found in Atari Basic. You've also had the opportunity to use a 'for-next' loop several different ways, and see how one loop can exist inside another, as seen in the program. The loop included in lines 30-90 executes before going on to the next C in the loop from 15 to 100. In terms of machine operations, the sequence of notes is played and plotted completely before the next color is introduced.

Another graphics command in Atari Basic that is quite useful is 'drawto'. It allows you to draw a line from one point to some other point without having to plot all the points in between. Try this program for starters:

```
10 GRAPHICS 3
20 COLOR 1
30 SETCOLOR 0,6,8
40 PLOT 5,18
50 DRAWTO 25,3
```

You should get a line of dots going up from the lower left corner of the screen moving at a slight angle to the right.

Now that you have some of the tools for coordinating sound and color graphics, you might appreciate the following program. It will play two notes, one after the other, and draw a line up or down on the screen, depending on whether the second note is higher or lower in pitch.

If you haven't seen one before, don't let the 'rem' statement in line 5 throw you. It only serves as a title; the program will run without it.

5 REM HIGH-LOW NOTES

```
10 GRAPHICS 3
20 COLOR 1
30 SETCOLOR 0,6,8
40 PRINT "IF THE SECOND NOTE IS HIGHER
THE LINE GOES UP, IF IT IS LOWER THE LINE
GOES DOWN"
```

```
50 FOR T = 1 TO 3000:NEXT T
60 A = 2:B = 12:N0 = 200
70 C = 6:D = 8:N1 = 100
80 GOSUB 400
90 A = 9:B = 10:N0 = 150
```

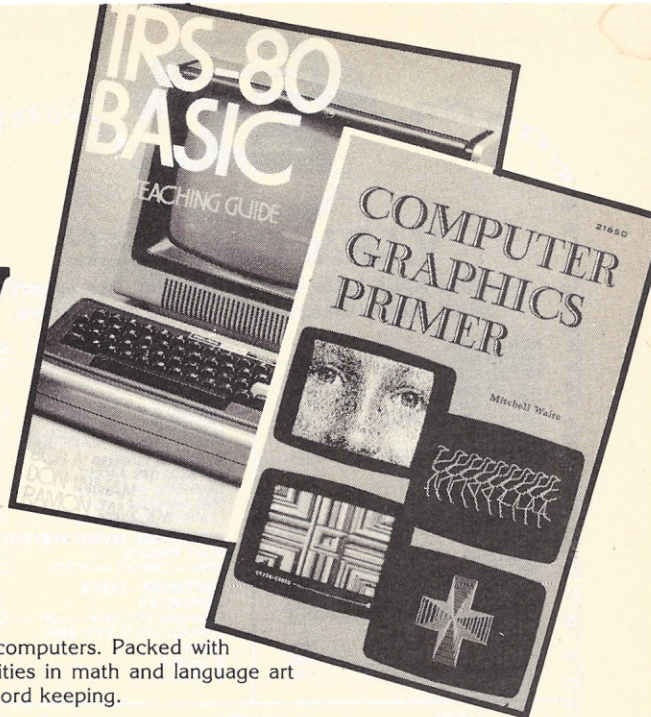

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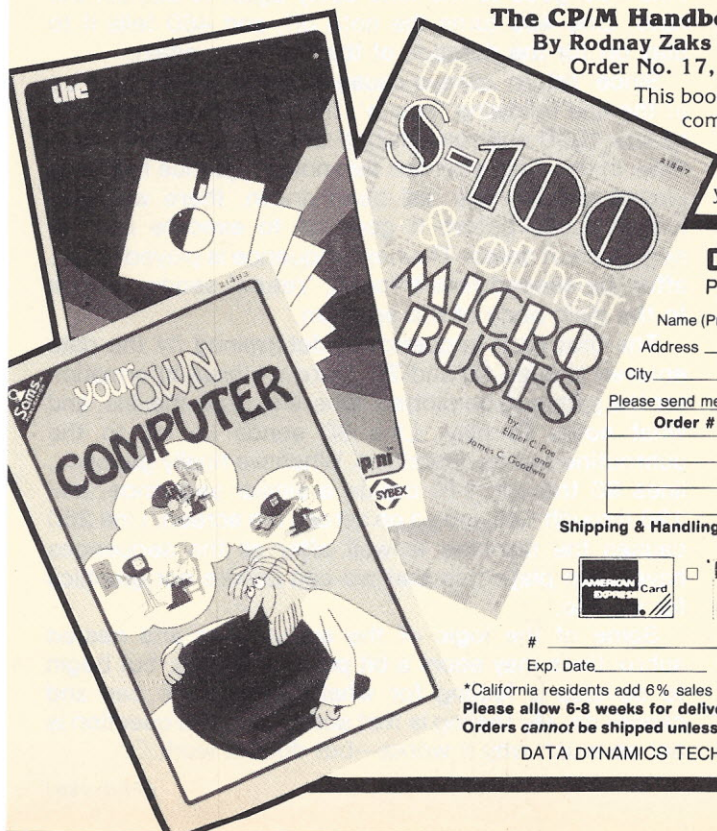
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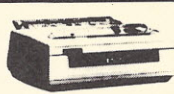
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	TI787 Portable KSR, 120 CPS	2,845	273	152	102
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CIRCLE INQUIRY NO. 76

100 C = 12:D = 14:N1 = 190
110 GOSUB 400
120 A = 15:B = 15:N0 = 210
130 C = 20:D = 5:N1 = 80
140 GOSUB 400
150 A = 22:B = 2:N0 = 15
160 C = 26:D = 17:N1 = 220
170 GOSUB 400
180 A = 29:B = 19:N0 = 250
190 C = 31:D = 0:N1 = 10
200 GOSUB 400
240 PRINT "THE END"
250 GOTO 250
400 PLOT A,B
410 SOUND 0,N0,10,10
420 GOSUB 1000
430 DRAWTO C,D
440 SOUND 0,N1,10,10
450 GOSUB 1000
460 SOUND 0,0,0,0
480 GOSUB 1000
1000 FOR T = 1 TO 500: NEXT T
1010 RETURN

Lines 10-30 are the initial graphics statements. Line 40 prints a description of what is to happen in the text window. Line 50 is a time loop that keeps the text on the screen long enough to be read.

Now look at line 400, which is a subroutine that first plots a point and then plays a note for values entered in the main body of the program. At line 450, we have a nested subroutine. This is simply a subroutine within a subroutine. It goes to the time loop in line 1000, sustaining the note for that duration. The 'return' statement in line 1010 will go back to line 430 and draw a line from point A,B to a point defined in the main body of the program for point C,D.

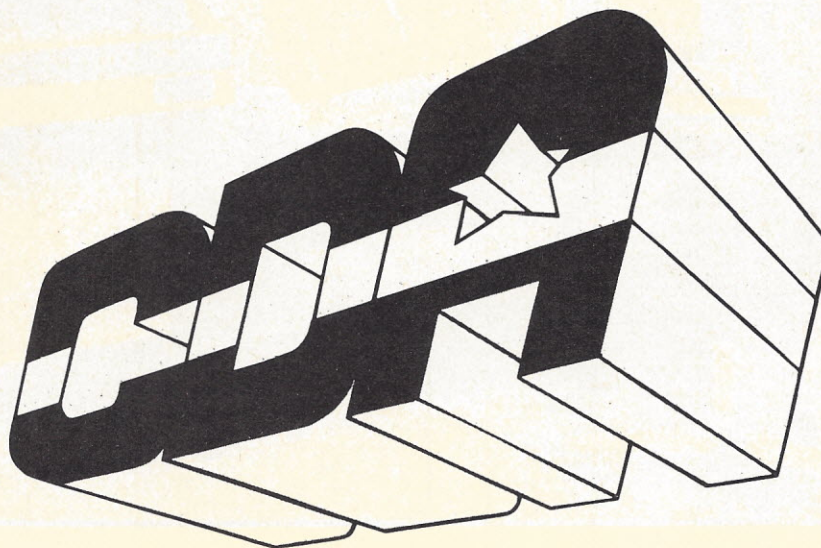
Line 440 will change the note played by voice 0 according to whatever value has been entered for N1. Line 450 goes to the time delay again to sustain the note. Line 460 turns the note off, and 480 tells it to stay off for the duration of the time loop again.

Since 'return' always causes the machine to pick up at the line following 'gosub', the machine will go back to line 1000 and run through the time loop one more time. In this way, after the two-note sequence has been played and the line has been drawn, there will be a longer pause before it goes on to execute another sequence of notes. The next sequence is played when, after the second time through, 'return' sends us back to the main body of the program.

The first such sequence is determined by the data entered in lines 60 and 70. Here we have information for the points to be plotted, where to draw the line, and what notes to play. Line 80 sends us off to the subroutine just as described. When we finally get back, lines 90 through 110 create a similar sequence, and 120 through 140 and so on across the screen. Line 250 causes the machine to wait after all the sequences have been played so that we can admire our graphics for a while.

Some of the logic of the subroutines and nested subroutines may seem a bit peculiar to you, but begin to develop a feeling for what the machine can and cannot do. My feeling is that sometimes the question is not so much why it works—but does it work. □

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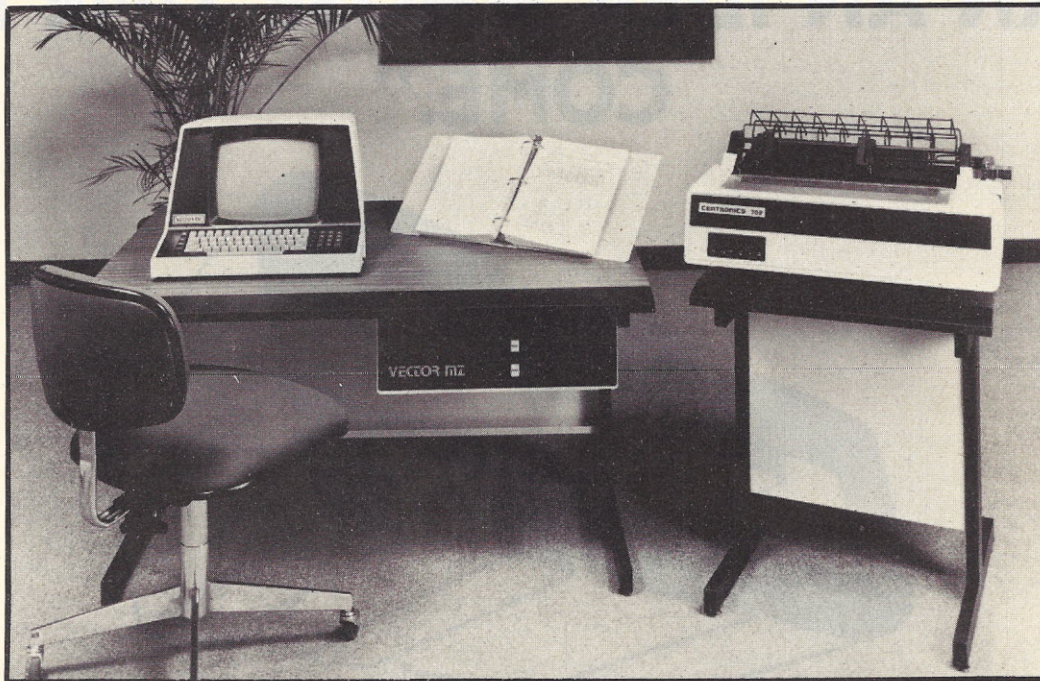
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Digital Micro Systems DSC-2

to be covered in future issues

by Hillel Segal

Once the sole product of Vector Graphic, the System B microcomputer system is now one of several small business computers offered by the fast-growing firm. The System B's success has led to new designs, based on similar internals but incorporating different packaging and a choice of disk storage units. Now, we

understand that Vector Graphic is upgrading the System B to give it a more useful role in the new product lineup.

Vector Graphic's entry level computer is the VIP, which is supposed to stand for "very intelligent partner." It looks different physically, but the insides are very similar in function to the System B which the Association of Computer Users put to a benchmark test. Like the System B our consultants worked with,

the VIP has 56K bytes of user-accessible memory and uses mini-floppy disk drives made by Micropolis. The major difference is that the System B uses a separate terminal (called the Mindless Terminal) which is connected to the main unit containing floppies and CPU. The VIP, on the other hand, has the intelligence built into the terminal housing, with only the floppies externally located. The basic VIP has one floppy drive holding 315K bytes, and up to three additional drives can be added. The System B has two floppies standard.

Two other products are now offered by Vector Graphic, and these come in higher on the price scale. The System 2800 is similar to the VIP in that the terminal houses the computer hardware, but instead of mini-floppies, it has two full-size (8-in) disk drives. These are mounted in a single case external to the terminal, and hold considerably more data. The full-size floppies also operate a great deal faster than the smaller Micropolis drives.

Hard disk surface drive added

At the top of the line for Vector Graphic is the System 3030. Its most notable feature is the incorporation of a hard-surface disk drive. This Winchester-type drive is a sealed (nonremovable) disk storing up to 32 M-bytes of information. Two of the mini-floppy drives are also included with the System 3030.

Looking at the line as a whole, it seems apparent that Vector Graphic, like several others in the small computer field, is getting away from the earlier design orientation of a separate dumb terminal and computer. In doing so, it has created a series of fully-upgradable systems apart from the System B. Beginning with a VIP, the user can change disk storage systems to create a 2800 and eventually a 3030. The System B, not part of this hardware-upgradable series, stands alone. Software, however, is compatible throughout all the Vector Graphic products.

With the VIP computer priced at \$3,995 and the System B at \$5,995 (complete systems less printer—the price as tested includes a \$3,000 letter-quality printer), it might seem the System B is on the way out. After all, the \$2,000 difference is quite a bit for the extra mini-floppy on the System B. But the System B can be used with up to five terminals at once, running separate applications, and has more free module positions in its S-100 bus card cage. Despite the change in design Vector Graphic has made with its new products, the company evidently wants to extend the lifetime of its first product, and to accomplish that it is preparing some changes to give the System B more powerful capabilities.

The major change to be made to the System B is a switchover from Micropolis drives to faster units with more storage, made by Tandem. The new drives will seek to the desired track much quicker, and according to Vector Graphic will effectively double the rate at which data can be loaded into or retrieved from the floppies. In addition, the Tandem drives reportedly hold 600K-bytes of data per disk, a big jump up from the 315K-bytes on the Micropolis.

To ice the cake, Vector Graphic intends to use a new, error-correcting code with the Tandem drives. Instead of just detecting data errors on the disk, the system will be able to correct the data and restore integrity in the event that dirt or mishandling crunches some bits on the disk.

Also upcoming for the System B is an increase in the speed of memory cycles, which was apparently accomplished by getting rid of "wait states" during memory operations. The result is said to be a 12% improvement in processor operation.

Our testing of the System B, of course, was performed on the old system without the faster drives or the improved memory cycles. But looking at the characteristics of the System B and the VIP, it appears a fairly safe guess that the same or similar test times would apply to both. In fact, those tests which do not make use of the disk drives—and there are several of them in the total set of benchmarks—would be very likely to run in the same time throughout the Vector Graphic product line.

Yes, the upgraded System B would be expected to perform better on the benchmark tests. On the I/O-intensive tests, which measure the speed of disk access, there should be a considerable improvement in the new System B over the old version, and the System 2800 and 3030 should be even faster.

But before discussing the results in detail, let's review the purpose and scope of the association's benchmark testing program. To begin with, we see it as a very useful part of the evaluation process for people thinking of buying a computer. We *don't* want to give the impression that it's the only important factor, or even the most important one.

There are five categories of speed tests involved in the benchmarks, designed to cover different aspects of the computer's operation. All the computers are given the same problems to solve and are timed as they do so. In most cases, the programs are written in

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Basic, but other languages are permitted with the exception of Assembler, which of course would run faster and therefore be unfair to other systems. The System B was tested in Basic, though Fortran, Cobol, Pascal and APL are also offered.

The System B's performance placed it about midway in the group of under-\$15,000 computer systems with which it is being compared. Its accounts receivable test time of 5 minutes, 56.5 seconds is a little below the average for the group of twelve tested thus far, but not drastically out of line. The System B did better in the tests which did not use the disk drive (the CPU-intensive and scientific/engineering tests), and is definitely competitive throughout.

In the area of software, Vector Graphic continues to offer the Peachtree accounting packages, which include separate modules for accounts payable, receivable, general ledger, inventory management, payroll, and data management. The highly successful Memorite word processing system is now at version III, and includes features such as a spelling dictionary (to check your documents against a 30,000-word file and flag any words not in the dictionary) and a help feature to give users a list of system commands.

The most significant new package Vector Graphic is offering is Execuplan, a financial planning language which is similar to its popular competitor, Visicalc. Execuplan is said to have several improvements over Visicalc. Not having tested the new offering, though, it would be unfair to make detailed comparisons.

Most of the users contacted during the benchmark report survey expressed overall satisfaction with Vector Graphic. The hardware was given good marks for reliability, and documentation was very complete. There were some problems with custom software which had been supplied by dealers, but aside from that, little complaint.

Probably the single most successful application for the System B is in the area of handling word processing and accounting for legal firms, according to one dealer we talked to. Small business bookkeeping was also mentioned, but there the size of the business had to be carefully watched to make sure that the limited storage of the mini-floppies did not become a major problem. The planned change in floppy capacity should help out there.

Offering reliable hardware at a low cost, Vector Graphic has been very successful with the System B. Now, by enhancing the model's storage system, the upgraded System B may still find a useful position within Vector Graphic's expanded product line. □

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several other foreign countries.

One of the association's key activities is the publication of its Benchmark Reports. Each month a new report is produced covering another computer system.

In addition, ACU publishes seven bimonthly newsletters for users of small computers, midi computers, large computers, time-sharing systems, distributed processing systems, word processing systems and home and hobbyist computers.

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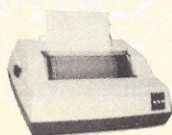
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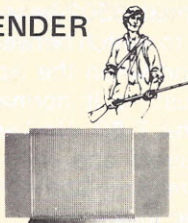


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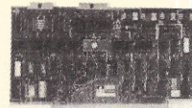


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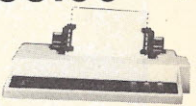
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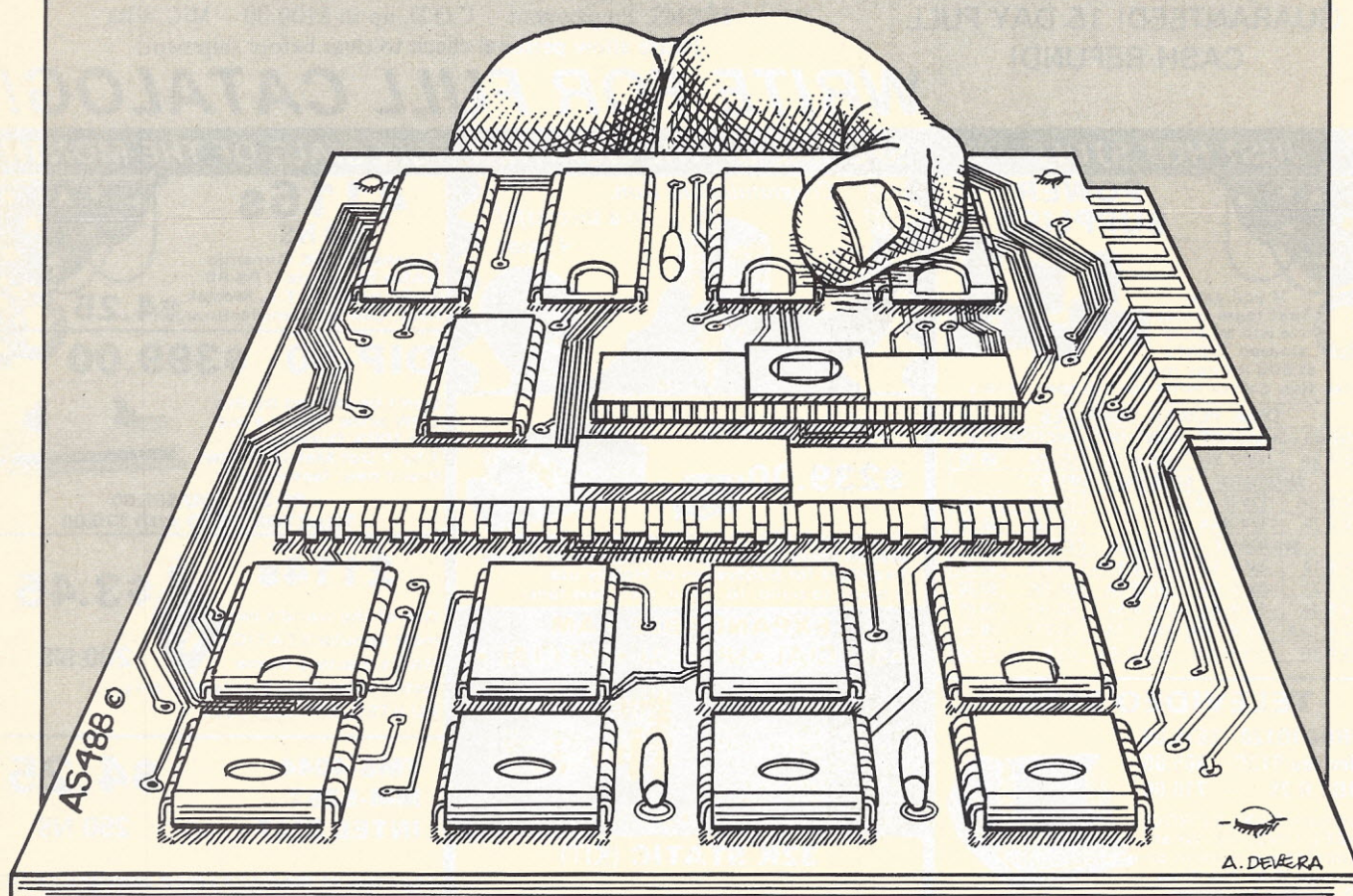
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A Hardware Solution for a Software Problem



The Microsoft Z-80 SoftCard — CP/M for AP

by Roger H. Edelson

CP/M, that software bus which has proven to be a boon to Z-80 or 8080 microprocessors, unfortunately has not been available to those computer hackers with Apple computers. This excellent operating system was written in 8080/Z-80 language, and is apparently not translatable into 6502 assembly language.

To rectify this problem, Microsoft Consumer Products (a relation to the same Microsoft that brought you Microsoft Basic and other goodies) has come up with an ingenious hardware solution to this software incompatibility—the Z-80 SoftCard. This is a peripheral card for use in the Apple II or II Plus microprocessors that possess a minimum of 48K RAM and at least one disk drive; the CP/M operating system and Microsoft Basic are supplied on an accompanying diskette.

SoftCard actually contains a Z-80 microprocessor and the necessary logic and control circuitry to allow

the Apple system to run software written for Z-80 or 8080-based microprocessors while the Apple still operates in its normal 6502-based mode. Software commands are used to switch between the two different microprocessors, and when the Apple is in the 6502 mode it behaves just as it normally would, with no interference from the Z-80. No hardware or software modification is required, and once the SoftCard is in place, the operator may run both CP/M and Microsoft's quite excellent Basic interpreter.

With both CP/M versions 2.2 and 5.0 of the Basic interpreter, the user can run any CP/M compatible program. There is only one worm in this Apple: CP/M disks have a physically different format than standard Apple disks and therefore cannot be run directly on the Apple system.

To run a CP/M program written for another computer, it must first be downloaded from a standard CP/M

system to the user's Apple system—a process which obviously requires two computers.

While Microsoft provides programs to enable this information transfer, most purchasers of SoftCard will undoubtedly elect to wait until a software house produces CP/M-compatible programs in Apple disk format.

Before installing SoftCard, position the Apple peripheral cards in a specific order—that is as if the computer were set up for Apple Pascal (figure 1). This is required

SLOT	VALID CARD TYPES	PURPOSE
0	Not used for I/O	This slot may contain a Language Card or an Applesoft or Integer BASIC ROM card. (The latter are not used by CP/M.)
1	types 2,3,4	Line printer interface (CP/M LST: device)
2	input: 2, 3,4 output: 1,2,3,4	General purpose I/O (CP/M PUN: and RDR: devices)
3	types 2,3,4	Console output device (CRT: or TTY:) The normal Apple 24×40 screen is used as the TTY: device if no card is present.
4	type 1	Disk controller for drives E: and F:. The Z-80 SoftCard may be installed here if not occupied by a Disk controller card.
5	type 1	Disk controller for drives C: and D:.
6	type 1	Disk controller for drives A: and B: (must be present)
7	any type	No assigned purpose. The Z-80 SoftCard may be installed in slot 7.

Placement of Apple Disk Drives

As indicated in the table above, Apple Disk II controller cards may be installed in slots 6, 5 or 4. You must have at least one disk drive installed in slot six. Disk controller cards are installed in order downward from slot 6, i.e., your second controller should be installed in slot 5, and the third in slot 4.

In CP/M, each of the drives is assigned a letter name, followed by a colon. For instance, the disk in slot 6, drive 1, is CP/M drive A:. (See table below.) This is the way we will refer to your disk drives throughout this documentation. You may want to label each disk drive according to its assigned CP/M name and it is for just that purpose that we enclosed the package of self-adhesive disk drive labels.

	CP/M name	Slot #	Drive #
1st drive:	A:	6	1
2nd drive:	B:	6	2
3rd drive:	C:	5	1
4th drive:	D:	5	2
5th drive:	E:	4	1
6th drive:	F:	4	2

NOTE for DOS 3.3 or Apple Pascal users:

Apple CP/M supports the large-capacity 16-Sector disk format used by DOS 3.3 and Apple Pascal, in addition to standard Apple II 13-Sector format.

Peripheral card placement

because of the manner in which Apple selects its peripherals, and because the Apple CP/M expects to find certain cards in specific slots.

It also enhances the convenience of CP/M to the Apple user as when the printer I/O card is installed in slot 1, which allows the user to refer to the printer without specifying a slot number. An additional caveat in the manual states: "As a general rule, any card directly

compatible with Apple Pascal without requiring any software modifications will probably be directly compatible with Apple CP/M as well. Other peripheral cards may be used if the software supplied by the card manufacturer is bound to your Apple CP/M system using the Configio program."

The actual installation of SoftCard in the Apple computer consists of six easy steps. Basically, all that is needed is to insure that four dip switches on the SoftCard are in "off" position. Open your Apple computer (with the power off, or course), plug in SoftCard, then close the computer.

Microsoft recommends that slot 4 be used for the SoftCard unless it is being used for disk drives E and F. In that case, any unused slot may be used, except 0.

To bring up CP/M once SoftCard has been installed simply requires selecting the appropriately formatted disk from the two supplied. One disk is supplied in 16-sector format for use if your Apple is currently configured for Apple DOS version 3.3 or Apple Pascal with the language card.

If your computer uses version 3.2 or earlier of Apple DOS, the 13-sector disk must be used. Once you have selected and inserted the correctly-formatted disk, the boot operation depends on whether or not an autostart ROM is installed. If it is, CP/M will boot up immediately upon power turn-on.

In the other case, it will be necessary to hit 'reset', then type the sequence '6 ctrl-K return'. For those unfamiliar with the 'control' sequences, ctrl-K is typed by holding down the 'cntrl' key while hitting the K key. Assuming you have used the correct sequence for the computer's configuration, the disk drive will chuckle softly to itself and, after a few seconds, will display:

```
APPLE ][ CP/M
44K VER. 2.20
(C) 1980 MICROSOFT
A>
```

With the display of the prompt A>, you are up and running. To fully check out the performance of the operating system, type the instant command 'dir'. If a listing of the files or programs resident on the disk is displayed, everything is fine.

At this point *immediately make a backup copy* of your CP/M disk. In my case, I usually make more than one and store them in a clean, dry, safe, nonmagnetic location. While programs or files are generally rebuildable—with some work—the loss of your operating system puts you totally out of business.

On the Apple I tested, the CP/M and the disk access seemed somewhat slower than CP/M run on my S-100 system. Further, there are some other operational differences, notably in the 'format' program, which is not as interactive as the one I am used to. Partly, this is due to the fact that only one configuration of the Apple system is provided, and therefore it is not necessary to allow for different disk densities, or double/single-sided drives...or even different versions of CP/M (1.4 vs. 2.0).

However, my Format program provides an asterisk each time another track is written; in this version of Format, set a statement saying 'formatting...'. To prove that one should really read the documentation, I had a somewhat difficult time bringing up the Format program because I insisted on answering B when asked which drive I wanted to use to format the disk.

The documentation is specific: B: must be used as is generally the case for all CP/M operations. The user should be aware that some CP/M programs may not accept the : symbol and some may require it.

The Copy program, while different from the one I am used to, seems more than adequate. It does not provide the interactive comments, but it does allow full disk copy and has a provision for copying just the system tracks—an obvious requirement for providing the CP/M working system on newly formatted disks.

The Apple version of CP/M offers a new program called Apdos, which allows the conversion of programs from Apple disk format into CP/M compatible files. Once this transfer is made, there is no need to use Apple DOS again, unless you acquire more Apple format programs. Also, provision has been included to change programs from the 13-sector format to 16 sectors. This can be very useful to Apple owners.

Because of its origin early in the days of microprocessing, CP/M was designed with a TTY machine as the main method of manual information entry. This legacy is seen in the handling of the character delete process in which the character to be deleted is "echoed" rather than just deleted. As a further consequence, some CP/M software expects the presence of specific keys.

Many keyboards, the Apple being one, are deficient in this area; notably the left square bracket ([) and the 'rubout' command are not available. To circumvent

this, the Apple CP/M includes a keyboard character redefinition table (table 1), which allows any key to be redefined as to the Ascii character code it will generate.

The Configio program allows reassigning these codes or adding redefinitions up to a total of six. One useful redefinition is to reassigning 'cntrl-C' to some other character to prevent the operator from using this command to break out of a Basic program: once you have done this, try getting out of Configio with 'cntrl-C.' As a matter of fact, try warm booting CP/M with 'cntrl-C' once you make the change. As 'cntrl-C' is used quite often in CP/M, the user is cautioned about this change.

SoftCard, itself, is somewhat larger than standard Apple cards but fits into any of the possible slots with no interference. It is really a quite remarkable hardware solution to a difficult software problem, using only 14 integrated circuits to provide dual microprocessor capability.

The board is fully socketed, a feature I appreciate. Nothing is quite so bad as having to tear apart your \$200 board to replace a failed IC. Sending it to the factory for repair is worse.

The construction techniques are of high quality—good solder masking, legible component identification, and a gold plated edge connector to enhance reliability. Microsoft has included sufficient noise decoupling capacitors to do an effective job. SoftCard uses a four-bit binary adder, the LS283, to add \$1,000 to all addresses. This effectively shifts the Z-80 interrupt addresses and the CP/M starting addresses out of the 6502 zero page of memory. All other addresses are also shifted by the same amount allowing a contiguous range of memory from '\$c000' to '\$efff' for CP/M.

Table 2 shows exactly how the translator functions. To keep the SoftCard buffers from driving the address bus when the Apple also wants to use the bus, these buffers are placed in their high impedance state whenever the Z-80 relinquishes control of the bus. A switch S1-1 has been provided to remove this address translation scheme if desired. Of course CP/M won't work in this case; the Z-80 addresses are merely buffered and presented to the Apple I/O bus unchanged.

High and low priority signals

Interrupt processing and DMA daisy chain are both fully supported even with the SoftCard in residence. If S1-2 is in the "off" position, the DMA daisy chain structure operates only when SoftCard is also "off". When the SoftCard is activated, it will refuse to recognize DMA requests from higher priority devices and will signal to lower priority devices that DMA activity is in progress.

When S1-2 is "on", DMA requests will be handled in the normal Apple fashion with some slight modifications in the timing, due to the presence of the SoftCard buffers on the I/O bus, until the Z-80 signals that it is finished with the current machine cycle by raising the DMA control line (pin 22).

The design of the SoftCard shows a very experienced understanding of the dynamic nature of the 6502 microprocessor. By careful design, it was possible to make the 6502 "refresh" operation completely transparent to the SoftCard and the user. No wait states have to be added to any of the Z-80 machine cycles.

One problem remains. Because of the dynamic memories internal to the 6502, one must be careful

Table 1
Keyboard character definition

+ + KEYBOARD CHARACTER DEFINITION + +

Ctrl-K -> [RUB
Ctrl-@ -> RUB
Ctrl-B -> \

ADD/DELETE/QUIT (A/D/Q) -

Shown in the table are three characters that have already been redefined: Ctrl-K, Ctrl-@, and Ctrl-B. These characters have been redefined to be often used characters that are normally unavailable on the Apple keyboard — "[", RUBOUT, and "\".

You can define additional characters, delete characters or return to the main menu by selecting A, D or Q, respectively.

If you type A to add to the table, the computer will display:

CHAR:

Enter the character to be redefined. A character may be entered in any one of several formats:

ch where ch is any character

2 or 3-character ASCII name

Ctrl-ch where ch is any character

LC-ch The LC- prefix is used to enter lower case characters when lower case is not available.

ASCII hexadecimal code (preceded by &H)
(may be used if the character cannot be typed. See the ASCII Code chart in the "Software and Hardware Details" section of this manual.)

If, for example, you wanted to redefine Ctrl-C as a NUL (ASCII 00) in order to prevent a user's ability to break out of a BASIC program by typing Ctrl-C, you would first type:

CTRL-C

after the CHAR: prompt.

Table 2
Translator function

The table below shows exactly how the translator functions:

Z-80 ADDRESS	APPLE ADDRESS
\$0000-\$0FFF	\$1000-\$1FFF
\$1000-\$1FFF	\$2000-\$2FFF
\$2000-\$2FFF	\$3000-\$3FFF
\$3000-\$3FFF	\$4000-\$4FFF
\$4000-\$4FFF	\$5000-\$5FFF
\$5000-\$5FFF	\$6000-\$6FFF
\$6000-\$6FFF	\$7000-\$7FFF
\$7000-\$7FFF	\$8000-\$8FFF
\$8000-\$8FFF	\$9000-\$9FFF
\$9000-\$9FFF	\$A000-\$AFFF
\$A000-\$AFFF	\$B000-\$BFFF
\$B000-\$BFFF	\$C000-\$CFFF
\$C000-\$CFFF	\$D000-\$DFFF
\$D000-\$DFFF	\$E000-\$EFFF
\$E000-\$EFFF	\$F000-\$FFFF
\$F000-\$FFFF	\$0000-\$0FFF

Notice that when the Language Card is installed, the Z-80 can address contiguous memory from \$0000-\$DFFF, without accessing the 6502 zero page of memory or the Apple peripheral area.

When the translator is disabled (SI-1 turned on) addresses presented by the Z-80 are buffered and appear at the Apple I/O bus unchanged.

All of the address buffers are tri-state buffers capable of sinking or sourcing 24 mA of current. All of the buffers are turned off whenever the SoftCard relinquishes control of the bus. The timing at turn-on and turn-off is arranged to prevent the SoftCard buffers from driving the address bus when the Apple is driving the bus.

The timing of the SoftCard forces all address transitions to occur during the time that the video display (and dynamic memory) is being refreshed by the Apple. Because for each memory access the address lines are stable at the start of the cycle, no wait states are used for memory accesses.

about the use of DMA devices, as when higher priority DMA devices are allowed to interrupt the 6502 refresh will not take place. If this timing is not carefully designed, the contents of the 6502 register may be lost. When the Z-80 is operating, its dynamic refresh lines are used to control this function so that the refresh operation occurs immediately after an op code fetch. The worst case timing still allows sufficient margin to prevent data loss.

Besides the actual card and the operating system disks, perhaps the most massive portion of the SoftCard is the manual. Divided into two volumes, the manual bulks well over 360 pages and includes a CP/M reference manual and a Microsoft Basic reference manual. For such a large publication it has very few errors, and Microsoft has corrected most of them in its Update #1, which was included with my purchase.

Software and hardware details are also addressed even including the Z-80 SoftCard schematic. The CP/M reference manual is apparently a reproduction of the manual provided with CP/M by Digital Research. Unfortunately, Digital Research apparently aimed its manual for experienced programmers and not CP/M novices. The system is not particularly easy to learn, but fortunately is relatively immune to beginner's errors. I strongly recommend the purchase of an alternate book that describes CP/M, its operational features, and the techniques of use.

The Microsoft Z-80 SoftCard represents a very real increase in capabilities for the Apple owner; at last he is able to use the large lexicon of CP/M compatible programs presently available. At the quite reasonable price of \$349, it provides a good "bang for the buck" ratio. □

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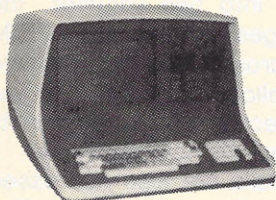
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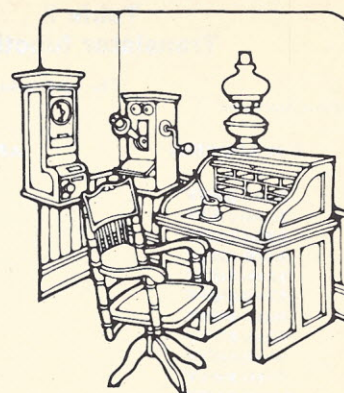
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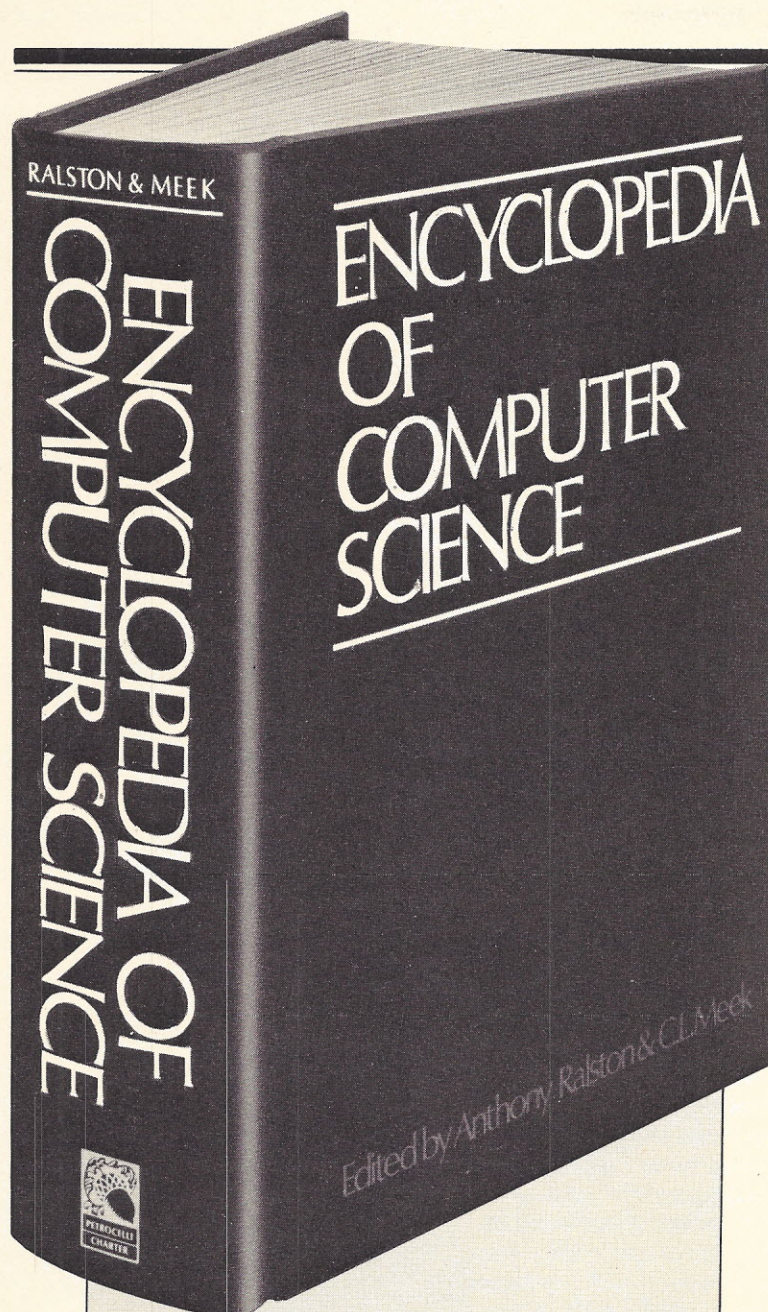
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a tour Through the home of the future



by Les Spindle

The 'home' in 'home computer' has never had a more literal connotation. With the recent opening of the Sun/tronics house in Stamford, CT, home living is a proposition that rests securely on the capabilities of a miniscule microprocessor chip. This showcase project, combining the most sophisticated solar energy techniques with the latest microcomputer advances, has been introduced by Copper Development Assoc. of New York. The near-million dollar facility, while scarcely on the verge of mass consumer acceptance, at least provides an intriguing peek at the home of the future.

The home features both active and passive solar heating, generation of electricity directly from the sun, plus computers that can act as servant, nursemaid, secretary, guard, in-home entertainer, and accountant. Two Apple II computers are at the heart of the home's energy-saving technology and luxurious conveniences.

According to Paul A. Anderson, CDA's vice-president in charge of construction marketing, the home was built to acquaint the building industry with the myriad possibilities in the copper-and-brass designed home, ranging from copper roofing through the interface of mechanical home functions with computers. While such a house is economically unfeasible for the average consumer today, Anderson sees the individual technologies represented as the wave of the future. He feels that home builders will implement the technologies, a few at a time, until they become widespread staples over a period of years. The Sun/tronics home unequivocally proves





Passive solar energy systems are aesthetically integrated as a part of the home's decor. In the living room (right), an 18-ft high column (left of the fireplace) provides 15% of the home's heating needs. Through an intake grill at the top, the column captures naturally-rising solar-heated air from the 2-story greenhouse. The air is circulated down by natural means through the various rooms via hollow concrete "air floors." The adjacent dining area (left) shares the double-faced brass fireplace and mantle with the living room.



In the kitchen, a remote terminal connected to the home's main computer can be utilized to retrieve recipes, menus and a list of what's stocked in the wine cellar. The possibilities for specialized programs to make kitchen functions easier and more convenient are limited only by the user's imagination.



The solar water wall in the family room consists of large water-filled copper tubes with a decorative bronze finish. It captures solar heat on the outside of the house by means of a copper absorber plate filled with prototype heat pipes that circulate the heat without mechanical assistance. During seasons when it is not desirable to store and radiate heat, the computer simply lowers a blind over the outside solar collector. The 45-in TV screen is hooked up to the home's master computer, so the family can play computer games, sports fans can retrieve past scores, and the children can get help with their homework.

The master bedroom includes a solar water wall similar to the one in the family room. Also in the bedroom is another remote terminal with TV screen, tied to the master computer in the library. Husband and wife can control the home's energy and mechanical systems and project their household budget or income tax. For maximum noise control, lead sheet is incorporated into the walls between this room and the entertainment area.



Insulating skylight drapes in the master bath are opened by computer when solar heat is needed, or automatically drawn to retain the room's temperature. The double-sided brass fireplace gives off maximum heat because it uses outdoor air rather than warmed room air for combustion, and has forced-air circulation around the firebox.



that they are, at least, physically possible right now.

As an example of solar energy technology, Anderson describes the house as "third generation" because it represents an unusually sophisticated interplay of both active and passive systems. Active solar systems collect, store and distribute solar heat with the help of pumps and fans. Passive systems collect, store and radiate heat without mechanical assistance.

The active system includes: an all-copper solar collector array, totalling 640 feet, that will supply about 45% of the home's space heating and domestic hot water needs and will heat the hot tub; a 150-sq-ft photovoltaic array generating electricity directly from the sun, supplying electrical needs of the active solar systems and emergency power and lighting; a domestic hot water bank incorporating a heat exchanger to automatically transfer heat from the hot refrigerant gases of the 4-ton heat pump to the domestic hot-water storage tank, significantly reducing the energy needed for domestic hot water; and air-to-air heat pumps for system back-up.

The passive system includes: a solar water wall made up of six 12-in. diameter water filled copper tubes behind south-facing glass warmed directly by the sun, so that the heated water in these storage tanks can radiate heat at night back in the living space; heat-pipe water storage wall heated by copper tubes on the exterior of the house by a copper solar absorber plate, enabling sun warmed freon vapor to move into water-filled storage tanks inside the house, transferring heat into the stored water there; an 18-ft tall energy column capturing air from the top and transmitting heat to rooms through concrete air-floors.

Computer-controlled energy saving features include: motorized insulated shades for large window areas and skylights, automatically powered down at night and up in the morning; automatic switchover power from either battery storage or utility power based on existing electrical demand; and combination of high and low voltage lighting systems with automatic control of both, enabling lights to be turned off or on, depending on time of day, security/burglary situations or during power blackouts.

The main computer system is in the library.

Here data is retrieved on the energy performance and continuously monitored. All aspects of the home's various mechanical systems are controlled. This system also monitors and operates the security systems, the burglar alarm, the fire sprinkler system and smoke detectors, and summons the police or fire department.

The second personal computer in the family room is geared towards fun and education applications.

The 5400-sq-ft. house has 3 bedrooms, 2½ baths, living room, library/communications center, dining room, wine cellar, kitchen, family room, laundry room, and a 2-story greenhouse/solarium with a hot tub. Furnishings are an eclectic blend of traditional and contemporary. Copper, brass and bronze are omnipresent—from a king-size four poster brass bed to a soaring 12-ft double-sided fireplace in mirrored brass.

Since its official opening in November 1980, the home has generated wide interest from a variety of people, according to Anderson. "Architectural students and the business community have been particularly curious," he says. "We're planning a number of group visits through the end of the year."

A retired couple is inhabiting the house to serve as managers "and to help us in the shake-down on the various systems in the house, everything from the hot tub to the computer applications," according to Anderson.

"They're adventurous-type people who are enjoying the opportunity to experience the luxuries of living in such an experimental home while helping us iron out the bugs. In the broad sense, what we're dealing with are home computers not just dedicated from the standpoint of controlling energy and

mechanical operations — but also automatic data collecting for the resident's personalized needs. The computers are accessible to the residents for all of those specialized applications we hear so much about — business, education, entertainment. And the residents have input in tailoring programs to fit their specific needs. What we've introduced is not just a black box dedicated kind of computer that will, so to speak, run the house. It's that...but it's more. The computerized home is an energy-saving mechanical marvel — but it's the highly personalized programming capabilities that will ultimately interest the average consumer." □



The heart of the home's computer system is in the library. Tied into a television set is a highly advanced microprocessor programmed to retrieve on the screen or on print-out all on-going data on the home's energy performance; continuously monitor this performance for maximum efficiency; and activate and control all aspects of the home's energy, mechanical and security systems. It also stores the miscellaneous data that might be needed in the kitchen, family room, or master bedroom.

The book you've been waiting for...

Ever since Radio Shack sold the first TRS-80 Model I users have been searching for detailed information about its inner workings that Tandy would not, or could not, make available. In particular the Level II BASIC from Microsoft contains dozens of subroutines that can be tremendously useful to any programmer, but Tandy Corporation is probably under contractual obligation to Microsoft not to supply information (if they even have it!).

Dedicated users, proficient in assembly language, have disassembled the Level II ROMs and made their own comments. But the majority of users are left in with virtually no information, apart from occasional articles and whatever they can decipher on their own.

ENTERPRISING USERS - Several of the more enterprising programmers realized that if they published their own comments a lot of TRS-80 users would buy them. The BOOK, Disassembled Handbook and Supermap are some of the available books giving comments on the ROM set - but they all suffer from serious drawbacks, being either incomplete, unintelligible or even worse - inaccurate!

Incomplete books are usually published when the author has not finished understanding what he's writing about. Hence the "continued next book" lines in some publications, translated into english read "buy another book when I've done some more work". Unintelligible books are due to poor editing, or no editing at all! Inaccurate information is a result of not checking with anyone else.

Microsoft BASIC Decoded & Other Mysteries is both complete and understandable. Nearly 7,000 lines of comments for the Level II ROMs, with an additional 6 chapters of useful information, make this the biggest and best book available on the subject.

Written by James Farvour, the comment section took more than a

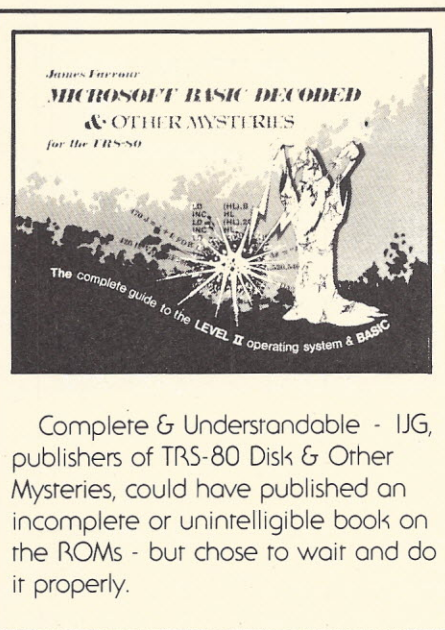
year to finish - it even includes the changes for the latest ROM set in an appendix. Edited by Jim Perry, until recently managing editor of 80 Microcomputing, the text and comments are understandable.

Tested examples are given for virtually every ROM subroutine, showing you how to CALL them from BASIC or use them in an assembly language program. With more than 300 pages Microsoft BASIC Decoded & Other Mysteries is by far the largest book about Level II available.

Copyright - In order to respect Microsoft copyright the actual disassembled code is not printed, but the book is designed to come apart and fit into a standard 3 ring binder with your own disassembly (all pages are pre-drilled).

In short, Microsoft BASIC Decoded & Other Mysteries, is the most complete, understandable and accurate guide to your Level II ROMs that is available - bar none!

☐ ☐ ☐ Pick one up at your nearest
☐ ☐ ☐ IJG dealer, phone your order
☐ ☐ ☐ in or use the coupon -
satisfaction guaranteed.



Complete & Understandable - IJG, publishers of TRS-80 Disk & Other Mysteries, could have published an incomplete or unintelligible book on the ROMs - but chose to wait and do it properly.

FOR TRS-80 USERS

Please rush me _____ copy/copies of **Microsoft Basic Decoded & Other Mysteries** @ \$29.90 each. Add \$1.50 shipping & handling per book.

Name (Print) _____

Address _____

City _____ State _____ Zip _____

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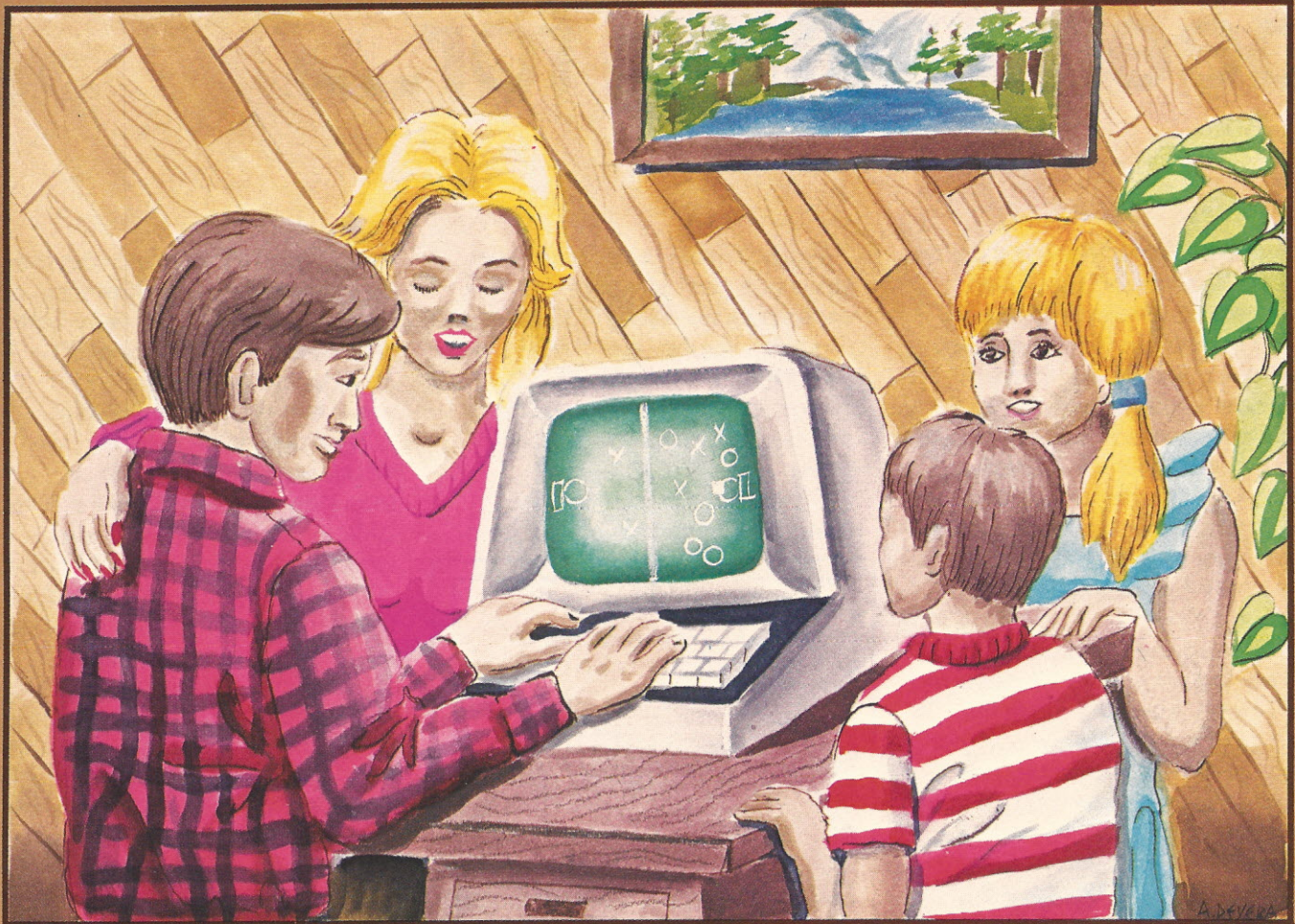
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* T.M. Microsoft † T.M. Tandy Corp.

The Latest in Personal Computers



by Tom Fox

What is a *personal* computer? The term suffers multiple and conflicting definitions, but the words certainly suggest a computer—a general-purpose problem-solving machine—that an individual can own and put to some good use. This immediately requires that price enter into the definition, since few individuals have the computing budget of businesses, traditionally the homes for computing power ever since the invention of the machine.

For our purpose, we define a personal computer as one that has the lowest possible cost and yet the capability of solving problems put to it by its owner. To really fit this definition, the device must be programmable by its owner, so we add that to the list of requirements. To be programmable in a high-level language, the computer needs a full keyboard, including at least all 10 numbers and 26 letters.

Computer-based games and toys don't qualify. Neither do pocket calculators, although certain programmable ones are very powerful indeed when applied to mathematical problems. Since they form a new class almost unto themselves, we have decided to deal with the "pocket" computers as a separate animal (IA Dec 80).

It turns out that we had little trouble assembling more than a dozen machines that fit our definition. Although

not a qualifying requirement, it's interesting to note that all of the machines include the capability for programming in BASIC.

Many of the machines we evaluated have a high entertainment value, in keeping with their home computing image. In addition, several can be expanded by the use of accessories and new software programs to perform useful business functions. All can serve as fine vehicles for education into the world of computers and computing. Many are specifically designed to appeal to children—definitely the place to start when acquiring knowledge in a field as complex and varied as this one.

APF Imagination Machine. This is really a grown-up toy, with features and attachments that continue to be added as the product proceeds through its development cycle. The core unit is a straightforward video game, complete with a pair of multifunction hand controllers. Each controller features four-way game paddles, a 12-key calculator-style pad and a big red "fire" button for Klingon-zapping. In common with many of the home computers, plug-in modules can be purchased to change the type of game being played.

This basic unit can be nestled into a keyboard module—a kind of a mother ship which greatly enhances the capabilities of the basic toy. A full typewriter-style

keyboard is included as well as a dual-track cassette recorder. One track is for the computer programs; the other for a simultaneous voice track.

The Imagination Machine we tested includes all of this, as well as a plug-in BASIC language program contained within a read-only-memory (ROM) module. The user can thus write BASIC programs, debug them, and save them onto a tape cassette for downloading at a later time. A selection of prewritten BASIC programs is also available, which exercises the impressive multi-color graphics capabilities of this microcomputer.

An Imagination Machine is a sort of hive computer, as no fewer than nine separate components must be plugged together to make the assemblage work. Two separate transformer boxes need to be plugged into a power outlet. The collection of interconnecting cables seems to attract knots and tangles as if by magic. We wouldn't be tempted to move it around the house a lot.

Surprisingly, this computer appears to rely upon software routines to clean up the tendency of all contact-type keyboards to emit multiple characters when struck by hesitant fingers. Certain of the APF-supplied software does a better job of this debouncing, as it is called, than others. A program with the promising name of Typing Tutor is particularly needful of more careful debouncing routines.

Astrovision Bally Arcade. A new accessory, the ZGRASS-32 keyboard is expected to transform the Arcade video game into a full-fledged, personal computer. When introduced, the BASIC-programmable machine will include a generous 32K bytes of user-accessible memory. An amazing 100K of memory (combined RAM and ROM) can be accommodated, giving lots of room for complex programs and data structures.

The owner will have access to unique BASIC commands to draw lines and boxes, and the ability to paint graphics pictures in an incredible total of 256 different colors. A nice TRACE function is part of the BASIC language that displays program statements as they are being executed. This kind of debugging feature goes a long way toward making life pleasant for computer programmers.

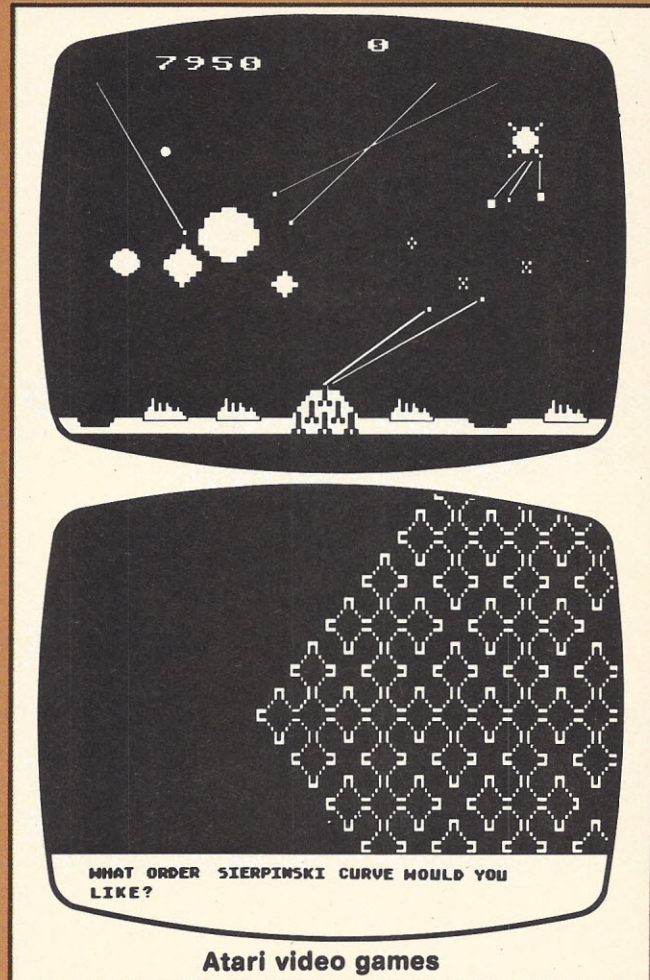
Apple Computer Apple II+. Few remember the Apple I, a bare-board computer, but the Apple II made quite a splash when it was introduced to the world almost three years ago. It was presented as a home computer, initially offering an integer-only BASIC as its sole available language. This was soon followed with a more-than-adequate Microsoft BASIC which takes up most of a 16K byte ROM and added a "+" to Apple's name. Enhancement followed enhancement, until the Apple has become a power to be reckoned with in the business computing field. The pioneering financial planning tool VisiCalc, for example, first came to life on an Apple II screen.

None of these developments has detracted from the Apple's desirability as a personal computer for home use. The computer is still capable of displaying color graphics of quite high resolution, or black and white patterns that can be very detailed indeed. The internal programmable music generator was clearly intended for entertainment, and lies as an unused resource in most business environments.

The machine's popularity has collected it a host of manufacturers who make plug-in enhancement circuit

cards. These can add everything from graphic input pads to light pens to an entirely different kind of microprocessor chip—the Z80A. This latter option opens the way to running CP/M, one of small business's *defacto* standard vehicles for running "serious" software.

The Apple II+, in fact, is probably the easiest entry on this month's list of personal computers to upgrade into a useful business tool. (The addition of floppy diskette drives and RAM memory would be necessary first steps along this path.) A recent price increase has pegged the entry price of the Apple at twice or even three times that of the more recent competition, but many of those would run out of steam fairly quickly if additional computing burdens were placed on them. The Apple II+, on the other hand, has proved itself to be quite capable in this role.



Atari video games

Atari 400. Atari has two personal computers: the 400 and the 800. The 400 costs half that of big brother 800, so it was our pick for this month's review. With its heritage of arcade-type video games, the 400, not surprisingly, has an excellent color graphics capability. With a maximum resolution of over 15,000 picture elements (pixels), each of 16 colors can be displayed in any of eight intensity levels. A wide variety of canned programs is available to show off this capability, but you can program such things as well with the built-in BASIC language interpreter.

The keyboard is the less-desirable diaphragm type, but the spacing matches that of the adult hand, a consideration not shared by other computers in this class. A fat catalog of optional accessories is offered,

including floppy diskette drives (both single and double density), three different printers, a cassette recorder, and game controllers galore. An acoustic-coupled modem option allows interconnection with the increasingly-popular public data bases.

Casio FX-9000P. Along with Hewlett-Packard, Texas Instruments and Panasonic, Casio has elected to stretch out of the pocket calculator market and plunge into personal computers. The FX-9000P, which we have seen only in prototype, evidences some well-integrated design concepts. It's an all-in-one design, with 5-in green and white display screen and keyboard (including calculator-style numeric keypad) sharing space with an array of four "slot-in memory units." The latter is Casio's version of plug-in RAM and ROM modules. The RAM includes a battery back-up, which allows the computer to retain information in memory even after it is unplugged from the normal power source.

The BASIC language will include commands to draw circles and other geometric figures directly on the high-resolution display screen. Optional features are expected to include a clock/calendar/alarm module, printers (including one for graphic output), floppy diskette drive and RS-232C serial interface capability.

Commodore VIC 20. When the Commodore PET was introduced a few years ago, it was hailed as the lowest cost mass-produced home computer available. The machine soon outgrew that role, however, and versions are now available with enough capability to handle the computing needs of a small business. Meanwhile, the



Commodore VIC 20 personal computer

advancing art of microcomputing has allowed the development of yet another generation of low-cost personal computers.

The new VIC 20 carries that banner once again for Commodore. Its under-\$300 price has caused consternation in the ranks of competing brands, and is directly responsible for the recent price reduction of the APF Imagination Machine. This, in spite of the fact that VIC 20s won't be generally available in the United States until midsummer.

Commodore's new entry is a look-alike to the Radio Shack Color Computer; both are computer-in-a-keyboard single unit designs. Connection is via an RF modulator to your TV set. The unit contains PETBASIC in ROM, and has most of the graphics capabilities of

the older brother PET. The VIC 20 also shares the PET's format for cassette storage, which means that programs may be interchanged between the two designs. Commodore is actively soliciting user-written software to add to its catalog. The best contributions will be converted to plug-in ROM cartridges for distribution to the masses.

Exidy Sorcerer II. This is the only computer on this month's list which utilizes the S-100 hardware bus, a staple in the business-class micro world. This comes as a surprise to some, as the appearance of the Exidy unit is much like the other personal computers: a low module not much larger than required to properly support a full-sized typewriter keyboard. The Sorcerer's Z80 microprocessor comes complete with the CP/M operating system, the ticket to literally thousands of applications programs.

New impetus assured

We were worried about the Exidy for a while, as things got a bit quiet after an impressive product introduction. Recent corporate manipulation, however, has given the company and its product a new life. The push these days is for "complete" systems, thus the higher price on our comparison charts.

Although the lower-cost Sorcerer I is still available, the model we saw includes a generous 32K bytes of usable memory and even a full-width printer. A floppy diskette drive isn't included in either system, but can be added later to bring the storage capacity up to a most impressive full megabyte of on-line storage.

Intelligent Systems Intecolor 3651. Until just recently, Intelligent Systems Corp. had the field of low-cost high-resolution graphics computing largely to itself. The 3651 is the most recent in a long line of such computers. The unit is massive, looking like an over-large video display terminal, complete with integrated keyboard. Also included is a 5¼-in. minifloppy diskette drive which holds 90K bytes of data in double-density format.

The aging 8080A microprocessor chip can be traced back to the first Intelligent Systems' designs, now nearly four years old. The disk operating system and BASIC language, both developed by the company, share this heritage. This doesn't mean that the product is old-fashioned. Indeed, the first Intecolor products were so far ahead of their time that only today is competitive pressure being seriously felt. The stability of the design concepts have one side benefit—if you have ever programmed on an Intecolor product, you will feel right at home at the keyboard of the newest offering.

The built-in color monitor displays eight colors (including black) with rich saturation and almost eye-hurting intensity. Characters can be specified in either normal or double height, and foreground and background colors can be specified individually for each character, if desired. The 3651 forsakes lower-case characters in favor of a set of artful graphics shapes for picture drawing.

The documentation is fat and even includes schematic diagrams for all circuits, but suffers slightly from a lack of organization. Included are shop procedures for power supply and diskette drive alignment, as well as color convergence of the display tube—a task that should be performed periodically to keep the display looking crisp and the colors pure.

Mattel Intellivision. With its forthcoming Keyboard Component, this shares a concept with the APF Imagination Machine: Begin with a video game, add a nest for it that also contains a full typewriter keyboard and cassette recorder and—*voilà!*—a complete personal computer. This approach gives the owner the bonus of a pair of hand controllers for games, a great many of which are available from Mattel.

The long-awaited Keyboard Component is due to be introduced any month now. We understand that the product is awaiting the completion of suitable software. Close behind are promised an exciting voice



Mattel Intellivision (intelligent television) system

synthesizer, printer and telephone modem. It looks as if the "you can tell it's swell" kids have joined the computer revolution.

Ohio Scientific C1P Series 2. This firm has one of the busier product development departments in the industry, regularly introducing new computers to the marketplace. The latest is the Series 2 line of Challengers, an upgraded version of the Superboard series of single-board computers that have been around since 1978. The microprocessor is the popular 6502 8-bit unit, known for its low cost, simplicity and remarkably high speed.

The new C1P includes its BASIC language in ROM, so that it doesn't have to be loaded into the machine from a cassette tape or floppy diskette. It also means that nearly all of the 8,192 bytes of programmable memory (expandable to 32K bytes) are available for use by your programs.

The music-making capabilities of this machine are spectacular. In addition to a variable-frequency tone generator, the computer includes a digital-to-analog converter, giving the programmer nearly as much control over sound-making as the keyboard operator at a rock group's synthesizer. Such programming is somewhat tricky, involving POKEing into absolute memory addresses, but the capability is there. You can buy programs on cassette which make music composition a less tedious and more natural exercise.

An unexpected bargain on Ohio Scientific's price list is the color TV/monitor option, only \$120 when pur-

chased with the C1P. This obviates the need for an RF modulator (which can cost \$50), and frees the family TV set for traditional uses. An important side benefit is that the image quality through this monitor is superior to that which any TV can supply.

The C1P will support a wide range of extra-cost accessories, such as a mini-floppy diskette drive, game joysticks, and a complete array of home security sensors and alarms.

Radio Shack TRS-80 Color Computer. Remember when there was only *one* Radio Shack computer? There were—and are—a lot of them around, but there was only one model: the TRS-80. The family has grown to five, with three of them introduced in a bunch near the end of last year. The "Color," as it is known around Fort Worth's Tandy Square, is priced squarely in the middle of the home computing market, and carries features which should ensure it a solid future in this intensely competitive arena.

The computer will display any of nine colors on your TV screen using an interesting variable-resolution concept. The 4K bytes of user memory are split in function between the graphics-generating program and the refresh memory of the screen itself. As more detailed resolution is required, more memory is taken up that can't be used by the program.

Each 64 by 32 patch of pixels on the screen takes up another 512 bytes of memory, until you run out of room to put the program that makes the display do something useful. The standard 4K of memory can be increased up to 16K, and this RAM area may be utilized to increase program complexity, graphics resolution, or a combination of both.

Radio Shack is becoming well-known for its excellent documentation, and the books shipped with the Color carry on this tradition. Far more than just "reference" books, these manuals actually comprise a self-instruction course in BASIC programming as it applies to this computer.

Rockwell AIM 65. Perhaps a surprise entry in the personal computer arena, the AIM 65 nonetheless shares many of the characteristics which bind this class of equipment together. It is small, reasonably priced and—above all—a remarkable vehicle for learning about computers and computing. In our detailed review of this product (IA Nov 80), we pointed out that the AIM 65 is somewhat more difficult to operate and comprehend than other computers, but the superb documentation supplied with the machine is a gold mine for computing students.

Display panel is key feature

This Rockwell computer is almost completely self-contained, including even a built-in printer. (Not supplied, however, is a power supply. You need to buy one separately at the local electronics supply store.) The machine does not have any kind of a video screen, nor will it connect to a TV set. Instead, it relies upon a single 20-character light-emitting diode calculator-style display panel. Included is the Microsoft version of BASIC in a plug-in ROM and electronic circuitry to connect two external cassette recorders simultaneously.

Sinclair ZX80. A whole computer for under \$200? It's true, and currently there's only one. It's the ZX80, available by mail order from Sinclair Research. The device is tiny, almost as small as the new pocket com-

puters recently introduced by Casio, Radio Shack and Sharp. An adult hand, spread wide, will completely cover it. This bodes ill for easy fingering of the keyboard, a problem made more severe by their snapping-diaphragm construction.

The computer is completely contained on a single circuit card sandwiched between two rather thin pieces of vacuum-formed plastic. The overall result is a rugged assemblage which is probably the only one on our list that could survive a toss across the room.

The price includes an informative instruction book which provides a good start into the art of BASIC programming. Several sample programs are provided to show off the capabilities of the ZX80. The language handles integer numbers only—no decimal points.

Entering a program is a cooperative effort between you and the computer. Each keystroke is assessed by the machine and improper entries are called to your attention with a "syntax error" character. If, later in the BASIC statement, you correct the problem (by providing closing quotation marks, for example), the accusing error message disappears. Until the syntax of each BASIC statement is perfect, the machine won't honor a NEW LINE command.

Inferior display quality

One of the least satisfactory aspects of the ZX80 is the quality of the display on the TV set. It's black-and-white only, and the character definition does not match the crispness of most other personal computers. The unit we tested overlayed the screen with an annoying herringbone pattern which shifted as the ZX80 was moved in relation to the TV set. Since the screen display function requires some of the Z80A microprocessor's power, it is blanked during the times when a BASIC program is running. This limits the kinds of program which can be written on the ZX80, since there is no convenient means of showing intermediate results during program execution.

But the ZX80 *is* a whole computer, and it *is* only \$199.95. It will introduce a lot of people to the world of computing. We just hope they don't think it's the best that science has to offer.

Texas Instruments TI-99/4. This is the slick result of a staggering amount of development by one of the major electronics companies in the world. It was one of the first machines which recognized that computers can be very entertaining indeed, given the proper execution. A pallet of 15 different colors and a four-channel sound synthesizer (including one which is pure "white" noise) have been utilized by TI programmer/artists to produce an array of demonstration programs to show off these flashy capabilities.

The programs are delivered in sealed ROM packs, and are not alterable by the user. The TI-supplied programs serve as a nearly-unattainable goal to those who would try to duplicate the effects in the BASIC language. The machine is capable of these wonders, but is the owner-programmer?

The TI-99/4 has enjoyed a recent price reduction, intended to correct the initial discouraging sales figures for this product. One recent addition is the RF modulator, a \$49.95 option that allows your TV set to take place of the \$374.95 TI color monitor. Other options include a unique voice synthesizer, which

includes a vocabulary of nearly 400 common English and computer-related words.

Every manufacturer must have its trick for cutting production costs. In the case of the 99/4, TI has eliminated the key that normally props up the typist's right-hand pinky. It takes some getting used to; but after a while you realize just how seldom a semicolon is encountered, even in the punctuation-rich BASIC language.

Mention should be made of the documentation which is a part of the TI-99/4 package. Two thick reference books, a BASIC quick-reference card and "read me first" booklet tell the world that TI feels that informative, comprehensive manuals are an absolutely essential part of any computer. We agree.

United Chem-con Cyber Vision 2001. Our last entry comes from a company new to this aspect of the electronics business. While more at home manufacturing military subassemblies and precision chemical milling, United Chem-con has developed a home computer built around the RCA 1802 8-bit industrial microprocessor. The package is a rather plain plastic box loosely filled with circuit cards and a built-in cassette recorder. The Cyber Vision's recorder wins the speed race by operating reliably at 2000 baud—equivalent to 200 bytes per second. This is more than six times faster than the slowest of the competition, and greatly reduces the waiting time for program loading.

The Cyber Vision has not one but two complete keyboards, which double in function as game controllers. The arrangement of letters and numbers is rectangular: A B C D E on the top row, F G H I J on the second, and so on. For a trained typist, using such a keyboard is

```
100 REM      INTERFACE AGE's benchmark program to
110 REM      'discover' the first 1000 prime numbers
120 REM
130 PRINT "Starting:"
140 FOR N = 1 TO 1000
150   FOR K = 2 TO 500
160    LET M = N/K
170    LET L = INT(M)
180    IF L = 0 THEN 230
190    IF L = 1 THEN 220
200    IF M > L THEN 220
210    IF M = L THEN 240
220   NEXT K
230   PRINT N;
240 NEXT N
250 PRINT CHR$(7)
260 PRINT "Finished."
270 END
```

Prime number cruncher

absolute torture; we despaired of even entering our tiny prime number cruncher benchmark program for that reason.

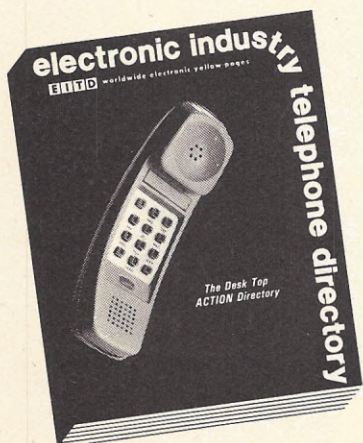
The BASIC language is contained within a plug-in ROM module which hangs rather precariously from a connector on the right-hand side of the unit. Cassette programs provided with the unit are amusing and well thought out. Like the APF Imagination Machine, the cassette recorder features a separate audio track which can be used for program explanation and enhancement. □

Tom Fox can be reached at FoxWare Systems Corp., 17925-G Sky Park Circle, Irvine, CA 92714, (714) 957-9332.



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GAMEMASTER — A COMPUTER WORLD OF ITS OWN

by Leah R. O'Connor

It's 7:00 Wednesday evening and in the living room of a house in Evanston, Illinois a group of avid war game players are arriving for their weekly meeting. Talk centers around last week's game and some of the strategies for tonight's game. In another room, two players are privately discussing a particular attack plan they intend to use. Soon all the players meet in the war game room to begin the evening's activities.

On other evenings, different groups meet to play cards, checkers, chess and backgammon. Fantasy-game addicts can be found playing Garnform's Maze, Catacombs, or the City of Rashkar. Guests drop in to play solitaire games or just wander around the house. During the day, school children visit the

classroom to brush up on math, history, or a foreign language. More often they are interested in sneaking down to the basement game rooms or down to the caverns below the basement.

Besides games, the house provides people with information. Bulletin boards exchange information about everything from favorite restaurants and recipes, to current entertainment and store sales. Members can also rent mailbox space and send messages to one another.

Let me take you on a tour. Upon entering the house we find ourselves in a large foyer. To our right is the mailroom, one of the busiest rooms in the house. To our left is the living room where visitors meet and talk.

Straight ahead is an old fashioned staircase leading to the upper floors. Behind the stairway is a door leading to the kitchen and beyond that the pantry, greenhouse and garage. Across the hall from the kitchen is the door leading to the banquet room.

If we take the stairs up to the second floor, we find a large library with many volumes, mainly about games. The center of the room is open all the way to the fourth floor and two balconies can be reached from inside the library or from the third and fourth floor hallways. A bedroom, conservatory, and workroom are also on the second floor.

Up on the third floor are conference rooms, news rooms, the guestroom, a darkroom and a storeroom. The conference rooms are probably the most used because this is where game players plot their strategies and hold private conferences.

The classroom is found on the fourth floor as is the picture gallery, the magic blackboard, a junk room and a couple of empty rooms. The classroom is probably the most used one on the fourth floor. It is here that children are encouraged to stop in and play educational games.

The attic of the house has been converted into an observatory, but the stargazing done here is more related to astrology than astronomy. Next to the observatory is the divination room, where hints of future happenings may be seen.

We end our tour in the lower level game room where most of the action takes place. In the stateroom, games like Diplomacy can be found. In the war room, we find members of the war gaming club engaged in games like Battle of Britain, Midway and Blockade Runner. Around the corner are the board game room and the clubroom, where card games are played. Games of fantasy and fiction can be found in the time room. If you like sports, stop in at the locker room where players prepare for baseball and football.

This house in Evanston is a private club for game enthusiasts. Visitors come and go any time of the day or night; the doors never close. It is run by a man known to his guests as the GameMaster. In reality he is Harlow Stevens Jr., a young imaginative businessman. *And the house is a construct inside the memory of a computer.*

Most of the visitors have never seen the small office on the border between Evanston and Chicago, which houses the three-story mansion. They visit the house from their own living rooms by using a computer terminal, a modem and a telephone.

In some respects the GameMaster's house is like many other computerized bulletin board systems that are becoming popular. The Source and Micronet now operate nationally, and more and more local bulletin boards are showing up every day. These systems have one thing in common: they all take themselves very seriously. GameMaster, however, is more than just a computerized bulletin board or electronic mail system, although it does incorporate both these features. It is a fantastic computerized playground for adults. A visitor not only needs a computer terminal, but more importantly he needs a sense of imagination.

Anyone who enjoys fantasy games, like Adventure or Dungeons and Dragons, will feel quite at home with

the GameMaster. If you own a computer, you can buy adventure games and play them for as many hours as you like. Why would someone pay an hourly fee to access a system to play the same type of games? The advantage of GameMaster is the interaction of players.

Two or more persons can play a game without leaving their homes or using an ounce of gasoline. In most fantasy games, the characters may be people sitting at terminals across the city or across the country.

Other interesting spots in the GameMaster's house are the alcoves where people can meet and talk. Every Tuesday evening, rates in the livingroom are lowered to encourage guests to come in and meet. While you are in the livingroom, anything you say can be heard by all the other people in the room. If you want to talk privately, you can move to one of the conference rooms on the second floor.

The GameMaster's house is designed for visitors. No one logs-in to the system; instead you knock on the front door and introduce yourself. Registered guests are admitted 24 hours a day. If you are not a registered guest, you won't be simply disconnected: you will be invited to sign up for a free tour during one of the monthly open houses. From the very beginning, the GameMaster's house gives the illusion of reality.

Entering it is like reading a novel. The GameMaster system works at 300 baud. This means that a stream of words is being sent to your computer terminal at about 320 words per minute. Since the average adult reads at about 200 words per minute, you will have to work a little to keep up, not that it is necessary to read at 320 words per minute.

The system has enough built-in pauses so that you won't be left behind. But there is a distinct advantage to forcing yourself to keep up with the computer. When you are reading at 320 words per minute, there is no time for bad reading habits, like rereading the same phrase, which interfere with the flow of ideas and images. If you allow your imagination to take over, you will find that, once you walk through the front door, the words on your computer terminal seem to disappear and your mind's eye takes over. This is why imagination is so important.

Many people prefer to use the graphics capabilities of their computer. Some of the games in the house are designed to work in either a text or a graphics mode. For example, if you own an Apple II, you can buy a special graphics driver program for the Catacombs game. With it, you walk through the tunnels and corridors of the cavern. With each step, perspectives change and new corridors and doorways appear. Graphics driver programs for other computers are planned for the future, but I prefer the text versions of the games, which will work on any terminal.

Last October at the Midwest Computer Show in Chicago, GameMaster previewed its newest game, Starship Simulation. GameMaster displayed the Apple graphics drivers for three of the five proposed Starship stations, the helm, navigation, and life sciences. The communications and engineering stations will be done soon. In the game, five different players will each take the part of a different crew member.



The game is based on the book *Starship Simulations* by Roger Garrett published by Dilithium Press, which details how a computer could be used to create a realistic simulation of a starship similar to the USS Enterprise. Although only the graphics of the game were working at the time of the show, they were very impressive. The Apple hi-res graphics were able to create a fairly good picture of the control panels for each station.

The GameMaster system, with its interactive people-oriented games, has potential. The house has been open for a little over a year and it is still growing. The people who visit regularly have been able to watch and to some extent participate in that growth. When new games are added, they go through a testing phase. There is no charge for playing the games being tested; players are just asked to report any bugs or problems.

Some of the rooms of the house are still under construction. In the bedroom on the second floor, there is an alarm clock, which will soon be able to call your computer at a prespecified time. Of course this requires that you have an auto-answer modem. The conservatory, which will be devoted to computer generated music, and the work room, both on the second floor, are still closed. On the third floor, the darkroom and storeroom are both closed, but the conference rooms, where you can talk privately to a friend, the guestroom, where announcements of current events appear, and library balcony, where you can read all the game rules, are open. The classroom, with its educational games, the library archives, and the magic blackboard are all open for business on the fourth floor. In the attic, both the observatory and the divination room are open. Some plans have been made to add more real astronomy to the observatory.

The GameMaster's house runs on an Alpha Micro system with 160K of RAM and a 10M-byte hard disk drive. There are six I/O lines dedicated to telephone users, four of these dialup lines are presently in use. The remaining two lines are shared between dialup

lines and staff use.

The staff needs to access their own system to help lost waifs get out of the GameMaster's house, and also develop new features in the system. One might even venture a guess that they play their own games from time to time.

The Alpha Micro can support up to 12 dialup lines, so the full expansion capability of the system has not yet been tapped. To quote Stevens, "We will not take on more customers than we can support." This has been a problem with other networking systems that have grown too fast and became oversubscribed. GameMaster currently has a little under 100 users. This is close to, but does not exceed, the capacity of the system as presently configured. Future expansion should permit GameMaster to accommodate more than the present number of subscribers. If the present hardware is overloaded, membership will be frozen; additional members will not be accessed until additional hardware is added.

For a small company, GameMaster has created an impressive system. It lacks some of the slickness and polish of top rate commercial software, but it makes up for this in its originality. There are many small bugs, and even a few major ones, but the GameMaster's house works...and works well. Despite the problems, I found it hard not to feel involved in the excitement of the people who are creating GameMaster.

Stevens' plans for the system envision a nationwide network of separate GameMaster Houses, able to communicate with one another and provide backup functions for each other. Each local system would be fairly small, supporting local groups, but able to call upon the resources of the overall network.

One advantage of the distributed networking concept would be the ability to 'stick' with small Alpha-Micro-type systems handling a few hundred users, while retaining the ability to expand the overall system indefinitely. This would eliminate the type of problems The Source has with bottlenecks at a single time-shared processor during peak hours.

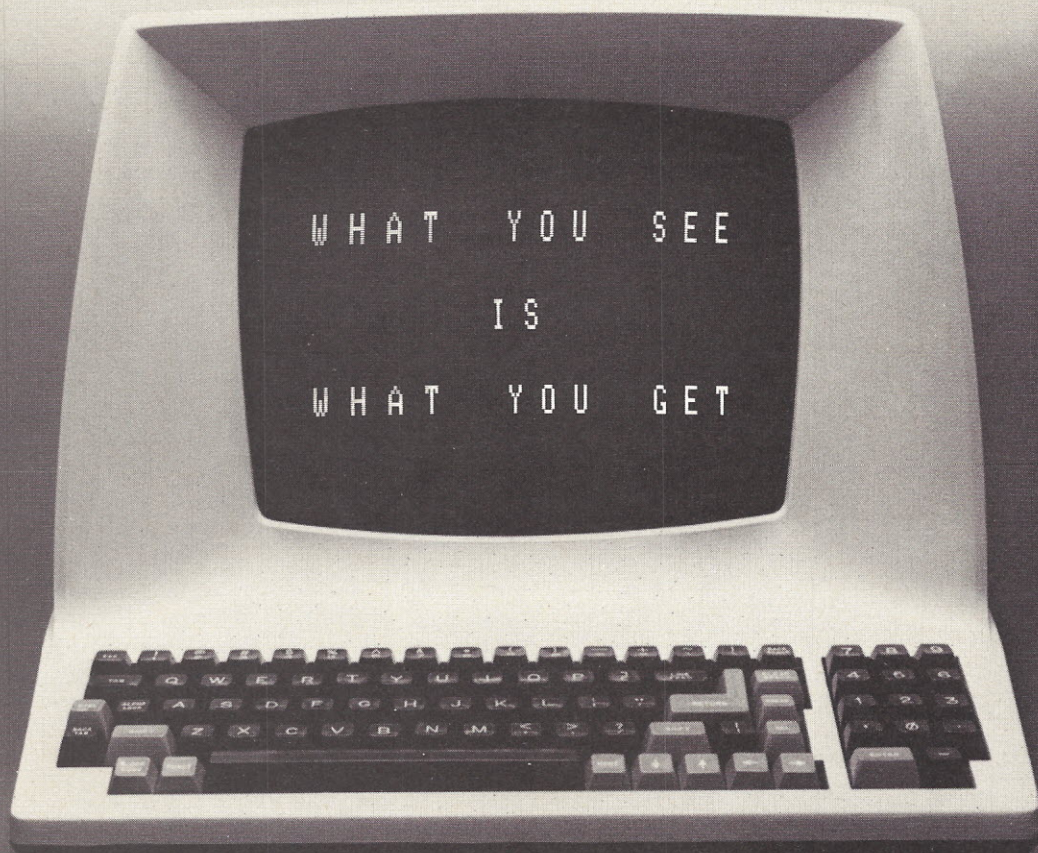
You can become a full member for \$65. This entitles you to copies of all game documentation, 360 credits (360 minutes) realtime access to the system, six months' use of the mailbox in the mailroom, and a subscription to *GameMaster Gazette*.

The 'a la carte' registration costs \$10 (to be a registered guest) and \$3 per hour for access to the system plus \$1 per month for a mailbox. A la carte members can buy the game-documentation notebook for a one-time price of \$10, and subscribe to the *Gazette* for \$15.

Full membership entitles the user to updates of documentation; 'a la carte' members would have to buy them. Full members get a discount rate on system time. A special rate for schools is available; \$50 per month for unlimited system time during weekday business hours.

The GameMaster's address is 1723 Howard St., Evanston, IL 60202. The house phone number is (312) 864-0516. If you need to talk to a 'human' instead of the computer, the number is (312) 328-9009. GameMaster also sponsors a free Apple bulletin board which can be reached at (312) 475-4884. □

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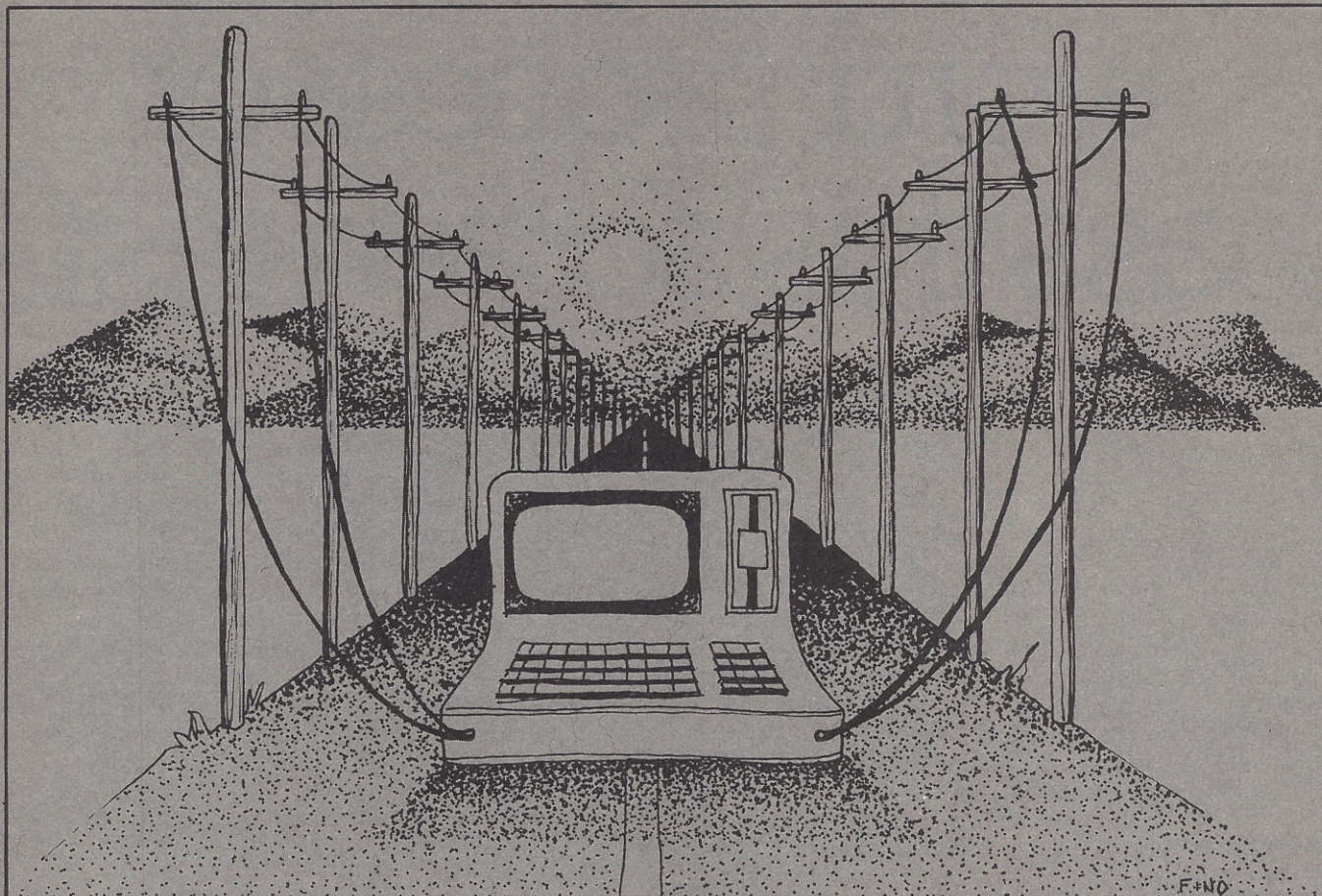
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CIRCLE INQUIRY NO. 52

Serial Communications and Interface Circuits in Microprocessor Systems



by Frank Toth

Microprocessor Marketing Manager
American Microsystems, Inc.

Serial communication takes place in two basic modes in microprocessor systems: asynchronous (unclocked) and synchronous (clocked). Within any given communications network there exists a protocol (set of rules) that ensures that the data transmitted is received as sent.

Asynchronous communication is used in relatively simple systems where low speed or irregular transmission rates are acceptable. Synchronous communication is used in relatively complex computer and multiple microcomputer/terminal systems where a relatively high data rate is required. Data transmission can be either character or byte oriented.

In a typical microprocessor system, the data from the bus must be

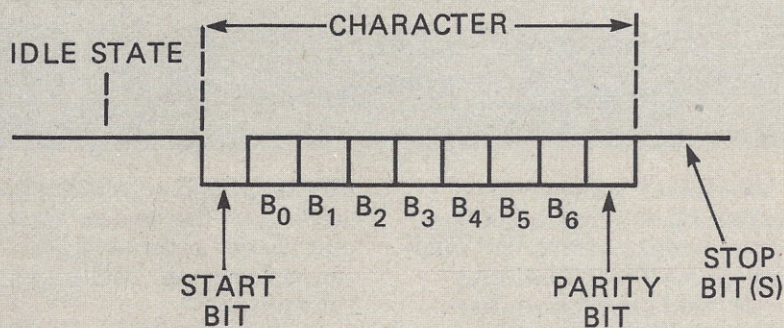


Figure 1. Typical asynchronous data stream

converted from a parallel to a serial format through some type of interface. In simple asynchronous systems, this is usually an asynchronous receiver transmitter (UART). In more complex systems using binary synchronous communication (bi-sync), a synchronous communications adapter (SCI or UCIA) is used to convert parallel microprocessor data to a serial byte stream with a clock. In extremely complex bit oriented protocol systems (BOP) having many points of reception and transmission, a complex device such as an advanced data link controller (ADLC) transfers data from a computer to a remote location.

In asynchronous communication networks, the lack of a clock forces the system to establish synchronization between the incoming data and the internal system on a bit-for-bit basis. When information is not being transferred, the communication line is kept in a known idle condition.

To establish the required synchronization, each character is transmitted with a start and stop bit to indicate the beginning and ending of each individual character. An idle state (figure 1) is assumed between each character.

In addition to the start and stop bit, an additional character known as a parity is used for error checking on a character-by-character basis. Asynchronous character codes vary, but a typical code ranges from five to seven bits. If a code of five bits is used, with a total of three control bits (one start - one stop - one parity), a total of eight bits is transmitted for every five bits of data.

Transmitting data

This is an overhead of 37.5%, which means that more than 30% of the total transmission time is used to transmit control bits. This is a rather inefficient method of transmitting data between points, but it is often used in simple systems such as teletypewriters, where there are large spaces between characters, and the total transmission rate is relatively slow.

A typical interface between a microprocessor and a serial transmission line in an asynchronous system is a UART (figure 2). The data from the microprocessor is loaded into the data holding register and transferred into the shift register, where it is shifted out one bit at a time. Logic circuitry within the

UART takes care of adding the start and stop bits and determining and adding the parity to the asynchronous transmission.

Checked by UART

The 8-bit parallel microprocessor data is transmitted to the outside world one bit at a time. The baud or transmission rate is determined by an external baud rate generator. The receiver section of the UART operates in exactly the opposite manner: serial data is clocked into the shift register one bit at a time, transferred into the data holding register, then to the microprocessor. The start, stop, and parity bits are automatically stripped and checked by the UART.

Asynchronous data communication is usually limited to low speed applications, but there is nothing that precludes asynchronous communication at high data rates. However, where high speed is required, reduction of the total overhead of the system is also desired. The

ultimate goal of the system is 100% utilization or zero overhead: data is transmitted with no protocol or start/stop bits. By simply eliminating the overhead, the overall data transfer rate can be increased without increasing the system baud rate.

One method of eliminating the extraneous bits required for transmission of asynchronous data, and at the same time ensuring synchronization, is through the use of synchronous or clocked communication (figure 3). Each of the bits of the data transmission is synchronized to the clock, which ensures synchronization among all portions of the system.

The idle mode for a synchronous data link is determined by the individual system and may include either mark idling or the repetitive transmission of special character. Information is usually sent in blocks or frames that may contain many characters.

These blocks of information are typically preceded by one or more

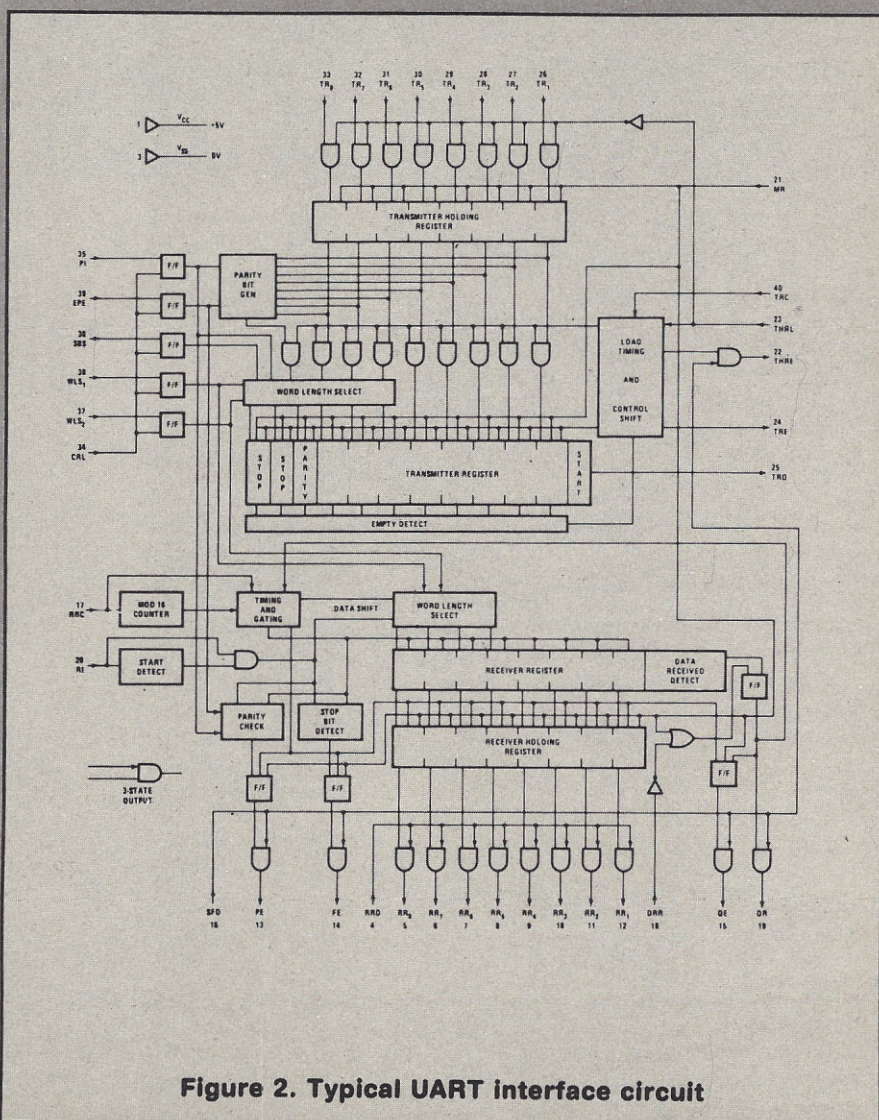


Figure 2. Typical UART interface circuit

sync characters that are used to supply frame synchronization. The principal advantage of synchronous transmission is to enhance the efficiency of the communication channel through the elimination of start/stop bits for each character.

receiver; (3) initializing the station and the transmission (the procedure and function performed depend on the protocol employed). Synchronous data protocols can either be byte control protocols (BCPs) or bit oriented protocols (BOPs).

address field, information field, control characters, and an error checking field.

Control character byte patterns (SYN, DLE, ETX) insure both synchronization and the proper operation of the communication network.

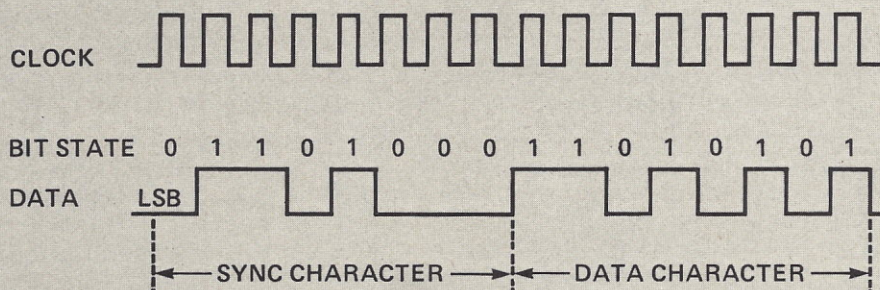


Figure 3. Synchronous data character format

A uniform method of sending and receiving information is required to allow communication between various computers and terminals within a system. A protocol performs such functions as: (1) establishing and terminating the conversations between two or more stations; (2) identifying the sender and

In the case of the BCP, a byte-wide set of control characters affects the synchronization and operation of the synchronous data transmission. Before the advent of BOP, the industry standard was bi-sync in which information is transferred in a block consisting of two or more sync characters and an

A restriction of the information field is that the bit sequence that matches any of the block control characters cannot be allowed to occur undetected, as this would be interpreted as a control character rather than data.

An exception to this requirement is in transparent bi-sync. In this mode, the data that matches the control character can occur in the data stream if it is preceded by a DLE character.

Transmission of information and bi-sync is limited to half-duplex. That is, the protocol requires an acknowledgement of the receipt of each block before another block can be transmitted. Once a communication channel has been established, the transmitter sends one block, then stops and waits for one acknowledgement (ACK) signal before sending additional blocks.

The receiver requiring the block checks for errors and sends them an ACK control character to the transmitter indicating that the block is correct, or an NAC control character indicating an error. Data is thus transmitted one direction at a time.

Character synchronization in synchronous transmission is accomplished by the recognition of a synchronization (SYN) character (figure 4). This circuit is capable of synchronous and asynchronous data communication, depending on the programmed operating mode. The device contains registers for a total of three control characters, two synchronization characters (SYN1

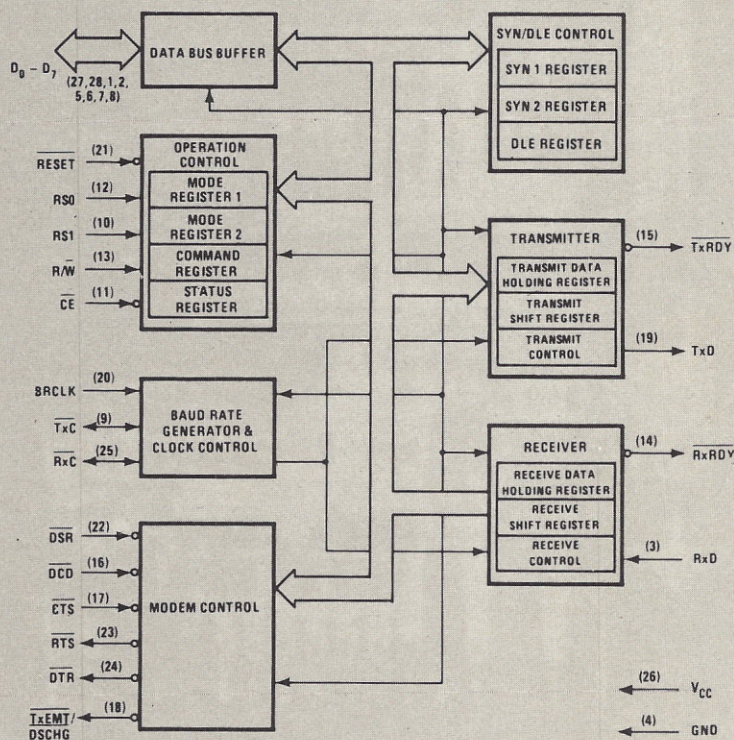


Figure 4. Typical synchronous/asynchronous interface circuit

and SYN2) and data link escape character (DLE).

In synchronous operation, the device senses the SYN characters and "locks" the receive logic to recognize both the SYN characters and the beginning and ending of all

five basic areas: beginning and ending flag; address area; control area; and information field.

The beginning flag designates the start of a frame of information while the address field designates the sender and receiver addresses.

nique is used. Once the opening flag is sent, the protocol requires that for every five ones, a zero is transmitted.

Because of the zero insertion technique and the uniform frame format, the code bookkeeping that

OPENING FLAG	ADDRESS FIELD	CONTROL FIELD	INFORMATION FIELD	FRAME CHECK SEQUENCE	CLOSING FLAG
01111110	N OCTETS	8 OR 16 BITS	VARIABLE	16 BITS	01111110

Figure 5. Typical BOP frame

subsequent data characters. This ensures character synchronization throughout the desired messages by inserting sync characters where needed to insure synchronization when data is not being transmitted (idle state).

If for some reason the device does not receive a character, it initiates a search mode to reestablish synchronization. Character synchronization relies upon the receipt of an entire sync word rather than on the timing of the individual bits.

There are several complications with bi-sync. First, control characters cannot be used as data codes, and byte patterns using these control characters cannot be transmitted as data. Second, information must be acknowledged before transmission can continue. To solve these two problems and further enhance communication network capabilities, BOPs were conceived. BOPs are used in the same high-speed synchronous serial applications as character oriented protocols, but avoid the bi-sync half duplex requirement. In addition, blocks received do not require acknowledgement each time they are sent. As a result, full duplex operation is allowable in BOP networks. Because of this ability to operate in full duplex mode, coupled with the fewer inherent handshake sequences, BOP networks can communicate at more than twice the effective data rate of bi-sync networks.

All communications in a BOP system (figure 5) are in frames of a uniform format. The frame is composed of a number of fields each with a definite location and precise meaning. The format consists of

The control field is used for the control of the information flow and determines the exact nature of the information message. The information field contains the actual data to be transmitted. The ending flag is the same as the beginning flag and designates the end of a frame of information.

To insure that the data is transparent (none of the data characters ever match any of the control characters), a zero bit insertion tech-

was required in bi-sync is simplified in BOPs, which use an implied acknowledgement technique to perform frame acknowledgement. This procedure is accomplished by assigning identification numbers (called sequence numbers) to the received and transmitted frames.

These numbers indicate the number of frames transmitted and received by the individual stations. Stations can compare the number of received frames to the number of

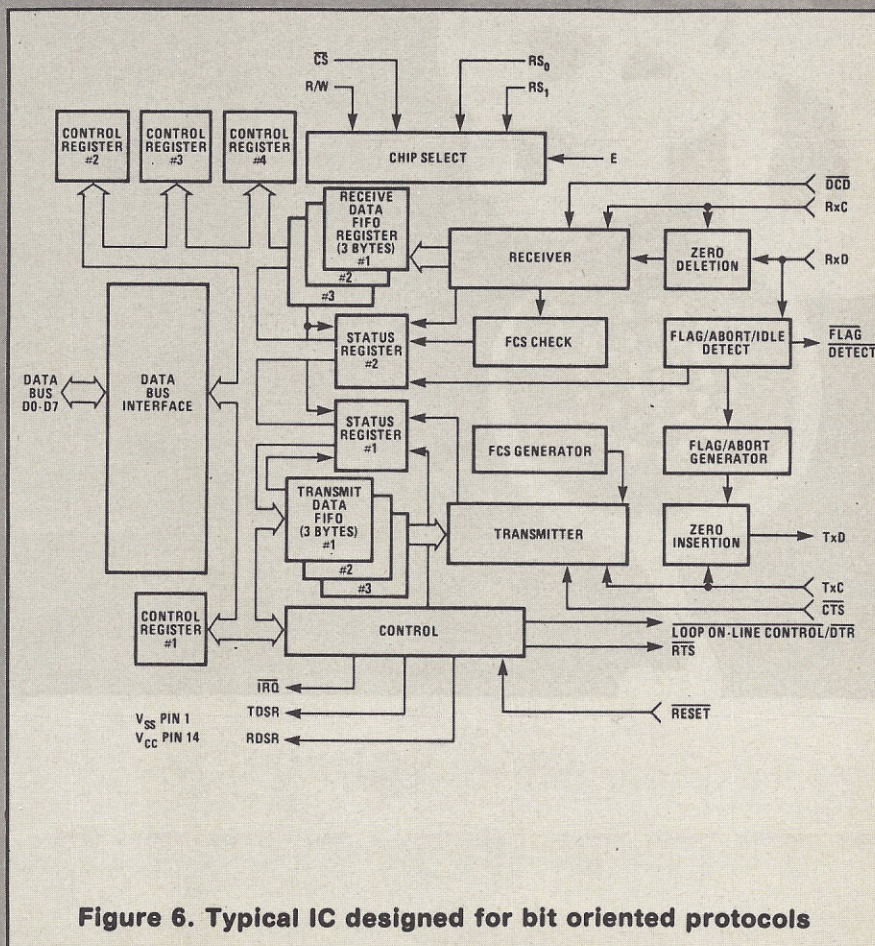


Figure 6. Typical IC designed for bit oriented protocols

transmitted frames and take appropriate recovery action should a discrepancy exist. It is no longer necessary to work in a stop/wait situation and send frames containing acknowledgement information only (as in bi-sync) thus permitting BOP

this higher throughput include fewer handshake sequences, fewer acknowledgement frames, fewer synchronizing characters, and fewer inter-block gaps.

There are only three major BOPs used: advanced data communica-

Information is transmitted in frames, and a frame is made up of a number of fields. In addition, there are two types of transmitting and receiving stations: primary (or control) and secondary (controlled).

The SDLC protocol, like most

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to operate in a full duplex (two-way simultaneous mode).

This is the primary advantage of achieving more than twice the throughput rate of bi-sync while employing the same type of communication facility. Other factors in

tions control procedure (ADCCP), high level data link control (HDLC), and the synchronous data link control (SDLC). These protocols have similar features, but the most widely used is probably the IBM SDLC (figure 6).

BOP types, is code independent. The only requirement is that the data being transmitted be contained in the information field of each frame. This concept allows for full duplex operation, since the number of frames sent and received is

recorded in the control field. In this way, secondary stations can transmit the number of frames received back to the primary stations. If this number does not match the number of frames sent, a request for retransmission occurs without the

sent, the protocol requires that for every five ones, a zero is transmitted; the receiver strips out the zeros automatically. In addition to SDLC, the circuit shown in figure 6 can handle HDLC and ADCCP protocols and can perform automatic

generate and transmit a frame check sequence.

The receiver also generates a frame check and compares it to the transmitted frame check sequence. If a match is not found, the receiver requests a retransmission.

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need for a confirmation of receipt of each individual frame.

The IBM SDLC protocol uses a beginning and ending flag for each frame. Zero bit insertion ensures that the code is completely transparent. Once the opening flag is

flag detection, synchronization, zero-bit insertion/deletion, and automatic frame check sequence generation and verification.

The frame check sequence algorithm looks at every bit (except the flag) and operates on each bit to

The SDLC protocol requires that frames be sent in their entirety or aborted with an abort sequence. The ADLC also permits the system to go into an idle state in one of two idle modes, and is also capable of a loop-back self test mode. □

Artificial Intelligence and the Personal Computer User

by Bernard Conrad Cole

Artificial intelligence (AI) is moving out of the laboratory and into the commercial marketplace. It will not be too long before the personal computer user can take advantage of what has been learned about AI to increase the level of his interaction with his personal computer. In short, what researchers have learned about AI will make communication between the user and his personal computer easier and much more efficient, especially in those areas relating to problem solving, natural language processing and the new discipline of "knowledge engineering," or how to represent knowledge and how to acquire and use it.

Such capabilities are beyond the memory and processing capacity of most personal computers on a stand-alone basis. But before long software packages—called "expert systems"—will be available as call-up services in the same way the personal computer user can hook up to information services such as The Source and Micronet.

These systems will offer to the personal computer user a level of expertise equal to that of human experts in limited areas of science, medicine, and mathematics.

Such expert consultation systems will help the personal computer user to solve conceptual problems and search for information in the same way a human expert in the same area would.

Ever since the early days of computing, the speed and processing capabilities of computers have inspired attempts to develop programs that exhibit intelligent behavior. Though intelligent behavior is difficult to define and is currently understood differently by different people, there has been some convergence of views as the technical requirements for the computer solution of certain classes of problems becomes better understood.

If intelligence is defined as consciousness, (or self-consciousness) there is no evidence that any computer, however powerful in structure or elegant in programming, will ever exhibit intelligence.

But if intelligence is defined on an objective basis, by observing the actions of intelligent beings, computers may in some respects be defined as intelligent.

The first task in defining artificial intelligence lies in determining the limits of the word "intelligence" as it is

normally understood. According to the dictionary, intelligence has at least three attributes:

1. the ability to learn or understand from experience; ability to acquire and retain knowledge.
2. the ability to respond quickly and successfully to a new situation; the use of the faculty of reason in solving problems in directing conduct.
3. in psychology, measured success in using these abilities to perform certain tasks.

Note that these attributes are measured by observation. A man's intelligence is determined by his words and deeds. The core of the argument for AI lies in the fact that a computer can be observed, by its words and deeds to behave in similar ways. A computer can learn. It can respond, when programmed with sufficient sophistication, to a new situation. It can solve problems. It can direct conduct. It can even answer certain questions from standard intelligence tests. In these matters, the observed behavior of a computer and a man's brain differs not in *kind* but in *degree*.

Both systems have a capacity to receive information, to store it and to deliver it on request at a later time. Both are capable of achieving similar results; that is, doing arithmetic, making decisions, doing deductive logic, solving problems and even learning. On the other hand, the differences at present are vast and may be classified as follows:

1. **Memory.** The human brain has an estimated capacity of about 10^{15} bits of information carried in directly accessible storage, in addition to auxiliary files in the far recesses of memory. The high speed random access memory used in computers at present involves 100 million bits, which may be expanded to about a trillion bits by auxiliary storage.
2. **Memory access.** The brain retrieves information by associating facts with other, while the computer deals with this task by saving the address of the information in the program itself or in a table to which the program has access.
3. **Learning.** Man is capable of being trained and of learning. This quality is still in its infancy as regards computers, despite advances in heuristic programming and learning machines.
4. **Creative thought.** True creativity, similar to that exhibited by man, is still lacking in computers.

One of the reasons is that we don't know a lot about how man himself arrives at ideas, inductive reasoning or generalizations.

In order to create AI in computers with some of the same attributes as man's mind, two general methods have been used. The first method involves the imitation of the structure of living neurons. This is the modeling approach, which has a basic research objective of trying to gain an understanding of the inside mechanisms of a real life system and to explain and predict its behavior.

The second method consists of upgrading present computers by improving their learning ability. This is the engineering approach.

It is the second category, the engineering approach, that will have the most impact on how personal computers are used, especially in relation to knowledge representation and the use of computers as "knowledge processors" rather than data processors or number processors.

Developing a knowledge base

The major thrust of development in AI in this area lies in defining what is meant by "knowledge representation" and trying to describe those areas of human knowledge that are useful as part of computer systems.

This view of computers as "knowledge processors" is a new attitude that has only recently begun to have practical applications in the design and use of computers. It represents a major shift in emphasis from programming a data processor to maintain and use a data base to constructing a program that makes use of a knowledge base.

In a data base, the conceptual organization is simple, and the problems are simply those of scale and efficiency. In organizing a knowledge base, on the other hand, there is no simple definition for what should be included or when it can be used.

The knowledge structure that a man draws upon in carrying out a task is many times more complex than most of the data bases now being processed on computers and must be built on several different levels.

AI researchers are investigating four major areas in knowledge representation in order to develop more intelligent computers and "expert systems":

1. Techniques for modeling and representing knowledge;
2. Methods that allow computers to think in terms of natural language, since theories of reason and memory are based on understanding how language works, how meaning is mapped into the structure of language;
3. Techniques for common sense reasoning, deduction, and problem solving; and,
4. Strategies for heuristic search, or how to focus quickly on a small number of likely solutions among a number of possible solutions.

The expert systems that will be of greatest use to personal computer users include problem solving software packages, question answering systems, and teaching programs.

The earliest AI programs involved such tasks as playing chess, proving theorems and solving puzzles. And this problem solving emphasis still dominates, although focus has shifted away from powerful, all-purpose methods to knowledge intensive systems in

which special attention is given to questions of representation and to control structures.

This problem solving research involves ideas having to do with the process of deduction, inference, planning, common sense reasoning and theorem solving—ideas that have been applied in programs for understanding natural languages, information retrieval, automatic programming, robotics, game playing and theorem proving.

Games and mathematical problems have often been used as a testing ground for problem solving and reasoning. Since the rules for moves and the criteria for success are clear, the major effort can go into the solution process, dealing with *how* the solution is, rather than *what* the solution is.

The game of chess has been one of the oldest challenges to the understanding of the problem solving process. Very quickly the shift was made from using the most sophisticated general purpose techniques to learning better ways of representing the knowledge of chess and organizing search control in deploying this knowledge. This research into chess playing programs resulted in showing AI investigators the limitations of conventional program organizations.

Although chess programs have been a popular area for demonstrating problem solving techniques, much more impressive results have been obtained in areas requiring more specialized knowledge—the so-called "expert systems" for chemistry, medicine, mathematics and electronics. Some of the more successful expert systems developed by AI researchers include: MYCIN, INTERNEST, DENDRAL, SECS, GPS (general problem solver), PROSPECTOR, and PECOS.

Computers programmed with INTERNEST or MYCIN, for example, can diagnose certain diseases as medical specialists. DENDRAL and SECS have as much reasoning power in chemistry as most graduate students and some Ph.Ds in the subject. DENDRAL infers the structure of large organic compounds and has developed techniques never before reported in the literature. GPS is a flexible scheme for reasoning about any subject. PROSPECTOR analyzes geological data and determines whether or not the data indicates the presence of minerals in sufficient quantities to be economically developed. PECOS develops alternative computer programs for implementing specific algorithms.

Diagnoses by deductive reasoning

MYCIN. This program, which is designed to help physicians diagnose infections, is an example of an AI system that can perform deductive reasoning. Its reasoning structure is not dependent on the knowledge set it interrogates and so could be applied to other subjects by reformulating some elements of the program and applying it to other data or knowledge bases.

MYCIN talks to physicians in English and informs itself about a problem by requesting information about the patient. This program contains a pool of knowledge about bacterial infection and is designed to "reason" with uncertain knowledge, much like man does. MYCIN uses information from this pool and reasons backward toward the bare facts known from clinical observation and lab data.

DENDRAL. This program, on the other hand, is a forward reasoning system which can jump from one hypothesis to another randomly, gathering evidence

for any line of reasoning. It has a pool of information about both the stabilities of various types of molecular structures as well as the methods of generating spectrograms of all possible molecules composed of these structures. When given the formula of a molecule and the spectrogram, this program uses its knowledge of stabilities to reduce the number of possibilities from thousands to as few as ten. It then generates the spectrogram for each and compares it to the actual spectrogram.

The DENDRAL system is in everyday use by chemists at Stanford University, their associates at other universities and chemists in industry. Users outside Stanford access the system via a terminal over a computer communications network.

Questioning the system

SIR, and its successor QA3, are typical question answering systems designed to perform reasoning based on techniques similar to those of formal logic. The most extensive of question answering programs is LUNAR, which, using a large data base provided by NASA, answers questions about the samples of rock brought back from the moon. One of the first programs to attack the problem of English grammar fully, it uses "procedural semantics" in which questions are systematically converted into a program to be executed by a retrieval component.

The economics of computing are now reaching the point where practical question answering systems can be put to use. IBM and Phillips, among many companies and research groups, are developing such systems. Although still in the development stage, it is likely that

commercial systems of this sort will be marketed in specialty areas where the questions to be answered fall within a fairly narrow area. One example is a system for answering questions about the stock market.

It has long been recognized that the ultimate effectiveness of teaching machines in computer aided instruction lies in the amount of intelligence incorporated into the programs.

In other words, a more intelligent program would be better able to formulate the questions and the presentations most appropriate at a given point in the teaching dialog. Moreover, it would be better equipped to understand the student's response and even analyze and model the knowledge state of the "student" in order to tailor the teaching to his needs. Typical expert systems in this area include SCHOLAR, SOPHIE and STUDENT.

SCHOLAR tutors students in geography, doing complex reasoning in deciding what to ask and how to respond to a question. SOPHIE teaches electronic circuitry by integrating a natural language component with a specialized system for simulating circuit behavior. Finally, there is STUDENT, which solves high school algebra problems formulated in a very restricted version of English.

Based on what has been learned from expert systems, such as those just discussed, about knowledge representation, it is certain that the next ten years will witness an explosion of commercial systems in such areas as medical diagnosis, chemistry, mathematics, economics, biology, the stock market, geology, physics and management strategies, among others.

Whether these systems begin to emerge in the early part of the decade or the latter, and in what form—microprocessor-based, as an offering from network information service firms such as The Source and Micronet, or as an integral part of a variety of data banks such as the New York Times Consumer Data Base—depends primarily on how much funding is applied, by whom and when.

Transforming to a knowledge processor

It appears clear that initially such expert systems will be available to personal computer users as a service of information networks such as The Source and Micronet and data bases such as Dow Jones for financial information.

The transformation of the personal computer into a knowledge processor using built-in expert system software packages will be more a function of memory and processor technology. Existing expert systems are designed for the memory requirements of minicomputers and mainframes. Two possibilities appear likely. First, tailored versions of expert systems requiring less memory will appear making the personal computer easier to use and converse with. Later as memory technology improves, the first approximations of the ultimate in personal computing—the self sufficient machine—will begin to appear.

This machine will learn natural language as people do, gain knowledge and reasoning power through experience, and be able to solve many of the same problems humans do. AI research indicates that the principles for building such machines are already available. The heuristics are now in place and need only be extended to further applications. □

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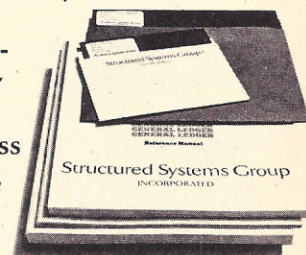
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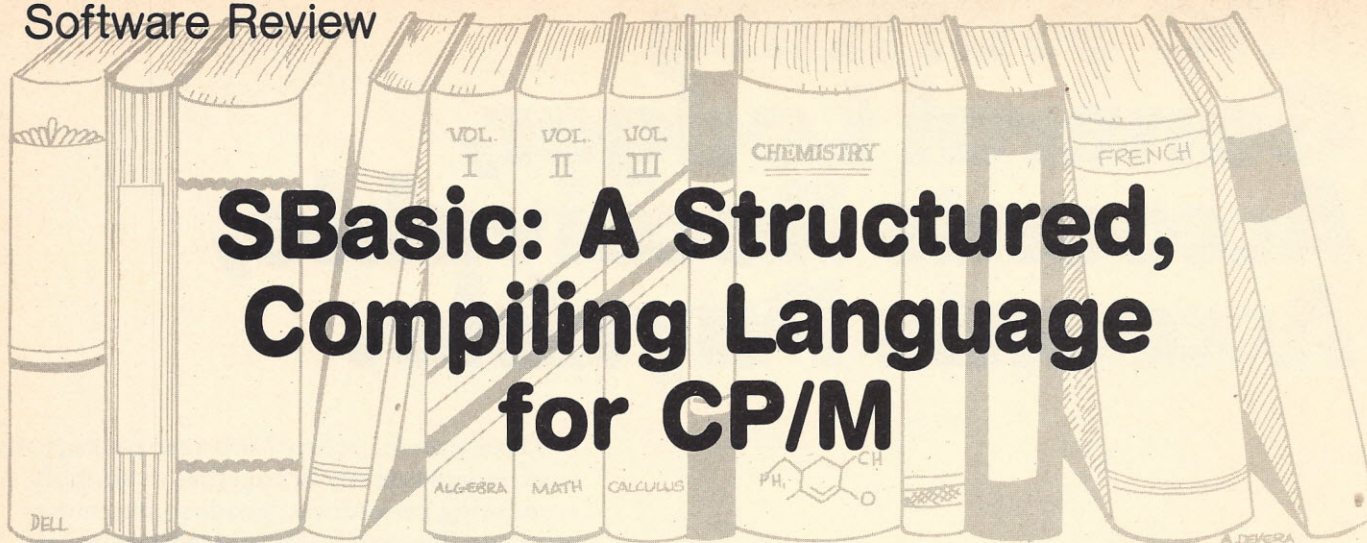


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SBasic: A Structured, Compiling Language for CP/M

by Alan R. Miller

If you want a microcomputer to operate your business, you need a good computer language. Cobol is business-oriented, but is difficult to learn and requires more computer resources than some of the others. Fortran was developed specifically for scientific use, and is not suited for business applications.

Pascal has recently become popular. Its block-structured style allows long names such as:

```
CURRENT_INCOME
```

With Pascal, it is possible to write programs that are easy to understand. This is an important factor in language choice. Computer programs need to be revised from time to time. But in order to revise a program, the programmer must understand how it works. For this reason, clarity of the source program is of major importance. Unfortunately, the current microcomputer implementations of Pascal are so large that there isn't much space left for the user's programs.

Then there is Basic—a language from the beginning of the micro age. Its first versions were rather primitive, but more recent entries are very sophisticated. Basic is particularly good for manipulation of strings (such as names, addresses). Two popular Basics are CBasic by Software Systems and MBasic by Microsoft.

CBasic (IA Aug 79) is specifically designed for business applications. Long names (up to 32 characters), integer variables, and BCD arithmetic are a few special features. CBasic is used in the following way:

1. Source program is generated with the system editor.
2. Source program is compiled into an intermediate file.
3. Intermediate file is executed by a runtime interpreter.

A different approach is taken by Microsoft with its two versions. Basic-80 (IA Apr 80) is an interpreter that includes an editor. Programs written with this editor or the system editor are interpreted directly. Execution can be stopped at any time, and intermediate results can be printed out.

After a program is running properly, it can be compiled by Bascom (IA Jul 80), a true compiler. The compiled version will typically run many times faster than the interpreted version. Floating-point variables can be declared as real or double precision. They are coded in

binary format. Variables can also be designated as integer or string.

There are several inherent problems with the general Basic language. A major disadvantage is that all variables are global. A subroutine designed to sort an array X cannot be used to directly sort an array Y. The array Y must first be copied into array X before calling the sorting subroutine. Then the sorted array has to be copied back into the Y array after sorting.

Another disadvantage of Basic is that only a limited amount of structure is available. For example, repetition of a group of statements can be performed with the loop construction:

```
FOR I = 1 TO N
    . . . (some statements)
NEXT I
```

Although it is not a standard feature, both CBasic and the Microsoft Basics also incorporate the 'while' construction:

```
WHILE I < 100 AND J > 10
    . . . (some statements)
WEND
```

They also include the 'if-then-else' construction:

```
IF I < 10 THEN J = 5 ELSE J = 10
```

Nevertheless these Basics do not incorporate the elaborate block structure characteristic of Pascal and Algol.

Now there is another alternative: SBasic (for structured Basic) by Topaz Programming. This language, distributed by Micro-Ap (San Ramon, CA), looks like a cross between CBasic and Pascal. It has many of the features of Pascal as well as the advantages of Basic. In fact, source programs can look like Pascal or like Basic. Programs are generated in two steps:

1. Source file is written with the system editor.
2. Source program is compiled.

The result is a binary COM file that can be directly executed simply by typing the program name.

As an example of a Pascal-like construction, consider the SBasic program in listing 1. Several features can be observed, the most obvious being the lack of line numbers. As with Pascal and CBasic, they are not needed except to define a location for branching. The

first character of the line number must be a digit. The remaining characters, however, can be letters. Thus:

GOTO Osort

Osort . . . Z

is a valid SBasic reference.

The block structure of Pascal can also be seen in the listing. In particular, the construction:

BEGIN

. . . (some statements)

END

can be used whenever a single statement is required.

There can be constructions like:

WHILE (logical expression is true) DO

BEGIN

. . . (some statements)

END

REPEAT

BEGIN

. . . (some statements)

END

UNTIL (logical expression is true)

and

IF (logical expression is true) THEN

BEGIN

. . . (some statements)

END

ELSE

BEGIN

. . . (some statements)

END

Another Pascal similarity is that all six variables must be declared before they are used:

INTEGER - 32767 to 32767

REAL 6 decimal digits, stored in binary

REAL.DOUBLE 14 decimal digits, stored in binary

FIXED 11 decimal digits, packed BCD

STRING (dynamic or fixed)

CHAR (A single Ascii character)

With MBasic you get the speed of binary arithmetic. CBasic uses BCD arithmetic for freedom from round-off error. But with SBasic you can select either one.

Another Pascal-like feature is the 'function' and 'procedure' construction. These are subroutines that have a list of parameters. They are called by name rather than line number. The arguments are local variables, but they must be scalars. That is, array names cannot be used. Hence a procedure for sorting the array X cannot directly sort the array Y.

Additional local variables can be defined within the body of the function or procedure. For some reason, however, these local variable names must be unique. As an example of a user-defined function, consider the modulo function:

FUNCTION mod(iim hh = INTEGER) = INTEGER

END = ii - int(ii/jj) * jj

Suppose that a new line is needed after every ten values of m. Then, the statement:

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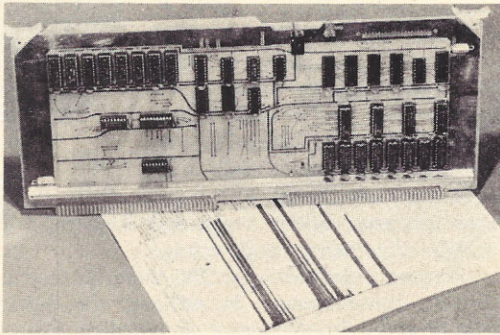
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CIRCLE INQUIRY NO. 59

FOR m = 1 TO 200

IF mod (m, 10) = 0 THEN print
NEXT m

will start a new line whenever the variable m is a multiple of ten.

Another feature of user-defined procedures and functions is that recursion is allowed. This means that a function can call itself. The classic example of recursion is the calculation of the factorial of the number. The program in listing 2 can be used to find the factorial. It includes the recursive function 'factorial'.

In the normal Basic syntax, parentheses are used for three different purposes:

1. To direct the hierarchy of operations
2. To enclose array subscripts
3. To enclose function arguments

Unfortunately, this makes it difficult to distinguish function names from array names. For example, 'sqr(2)' refers to the square root of 2, but 'sort(2)' might refer to the second element of the array 'sort'. Pascal, on the other hand, uses square brackets to enclose array subscripts and parentheses.

In SBasic, parentheses, square brackets, and braces are all equal. Thus, square brackets can be used to enclose array subscripts and parentheses can be used to enclose function arguments. Furthermore, a set of nested operations can be written with parentheses within square brackets that are within braces. For example, the power series:

$$Y = A + BX + CX^2 + DX^3$$

can be encoded as:

$$Y[I] = A + X[I] * \{B + X[I] * (C + D * X[I])\}$$

While SBasic is like Pascal in a number of ways, it is more like ordinary Basic in other ways. For example, values are assigned to variables by using an equals sign rather than with the colon equals sign used in Pascal. Statements are terminated with a carriage return rather than a semicolon.

SBasic does not allow more than one statement on a single line. However, statements can be continued on the next line. A backslash is used for the continuation symbol, a punctuation also common to CBasic. Single Ascii characters are enclosed in apostrophies while strings of characters are enclosed with quotation marks:

STAR = '*'

HEADING = "Month of March"

The 'for' loop is completed with a 'next' statement whereas there is no corresponding closing statement in Pascal.

SBasic expands on the easy-to-use input and output commands of ordinary Basic. The four variations of the 'input' command allow a specific tailoring of the prompt.

```
INPUT "prompt"; response
INPUT 1 "prompt"; response
INPUT 2 "prompt"; response
INPUT 3 "prompt"; response
```

The first and second versions print a question mark at the end of the prompt message, whereas the third and fourth forms do not generate a question mark. On the other hand, the first and third forms automatically issue a carriage return and line feed after the input has been entered. For the second and fourth versions, the

user must press the carriage return after the data has been entered.

An additional feature is available with the 'input' command. The input device is normally the console, but the CP/M reader can be used if device 3 is specified in the 'input' statement.

The 'print' command is also versatile. The output can be specifically formatted with the 'print using' command, and the output device can be specified in the 'print' statement.

SBasic assigns the channel numbers 0, 1, and 2 to the CP/M logical console, list, and punch devices. The user can specify in the 'print' statement which device is desired:

```
PRINT #device; information
```

As an example, the following fragments could be placed into a program:

```
$CONSTANT cons = 0
$CONSTANT list = 1
VAR response = CHAR
VAR device = INTEGER
```

```
device = cons
INPUT "Output to list"; response
IF response = 'Y' or response = 'y' THEN \
    device = list
```

```
PRINT #device; list_of_things
```

In the first two lines, the symbols 'cons' and 'list' are initialized to the values needed for the console and the list devices. These values are actually set at

compile time and cannot be altered during execution of the program.

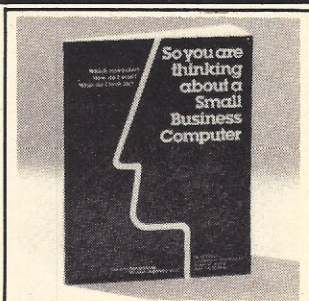
The next two lines declare the variables 'response' and 'device'. The output is initialized to the console in the next line. The user is asked whether output is to be sent to the list device. If the response is positive, the value of 'device' is changed to the list device. With this arrangement, a program can be executed once with the results displayed on the console. If everything is all right, then, on the next cycle, the output can be sent to the printer. This technique cannot easily be performed with other Basics.

Long messages can readily be displayed on the console or printer by using the 'text' command rather than 'print'. For example the sequence:

```
TEXT #list, \
1. first line
2. second line
3. third line
\
```

will send the text between the backslashes to the device defined by the symbol 'list'. The carriage return and line feed at the end of each line of the message are included. If backslashes are needed in the body of the text, some other character can be used for a text delimiter.

A unique built-in function, 'xlate', can be used to convert a string of characters into a different string of characters. A simple use for this function is to translate lower-case letters to upper. A program that reads customer names from the keyboard could convert forms such as Smith and smith into SMITH. This function could also be used to encode and decode



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A key string is set up as an encoding template. The characters to be encoded are used as indices into the desired position of key string. For the conversion of lower case to upper case, the key string contains the entire Ascii character set in its normal order. The lower-case letters, however, are replaced upper-case letters.

An extensive set of disk commands allows both random access and sequential access to files. The CP/M disk directory can be searched, filenames can be created, changed, and deleted.

A program that is too large to fit into memory can be executed as a series of smaller modules. A common block of variables is declared at the beginning of each module. A 'chain' command at the end of each module initiates execution of the next module in the sequence. It is also possible to load and execute a non-Basic program with the 'execute' statement.

It appears that the designer of SBasic has carefully chosen the best business-oriented features of previous Basic and Pascal compilers. □

Listing 1. Pascal-like structure of SBasic.

```
COMMENT
    Simple guessing game to demonstrate SBASIC
    computer picks a number, user tries to guess
END

VAR
    \
    highest_number, lowest_number, \
    computer_guess, user_guess, \
    number_of_guesses = INTEGER
VAR answer = CHAR

BEGIN (* main program *)
    highest_number = 100
    lowest_number = 1
    REPEAT
        BEGIN
            computer_guess = int( 100.0 * rnd(1))
            number_of_guesses = 1
            print "Guess a number from "; lowest_number; \
                " to "; highest_number; ": ";
            input2 user_guess
            WHILE user_guess <> computer_guess DO
                BEGIN
                    number_of_guesses = number_of_guesses + 1
                    IF user_guess > computer_guess \
                        THEN print "Too high";
                    ELSE print "Too low";
                    print "try again: ";
                    input2 user_guess
                END
            END (* while *)
            print computer_guess; " is correct"
            print "Number of guesses was "; number_of_guesses
            print "Do you want to try again";
            input answer
        END
    UNTIL answer = 'N' or answer = 'n'
END
```

Listing 2. Calculation of the factorial by a recursive procedure.

```
VAR x, y = real

FUNCTION factorial( argument = REAL) = REAL
    IF argument = 0 \
    THEN argument = 1 \
    ELSE argument = factorial(argument - 1) * argument
END = argument

REPEAT
    BEGIN
        input "x="; x
        y = factorial(x)
        print "Factorial of 'x'; " is "; y
    END
UNTIL x = 1
```

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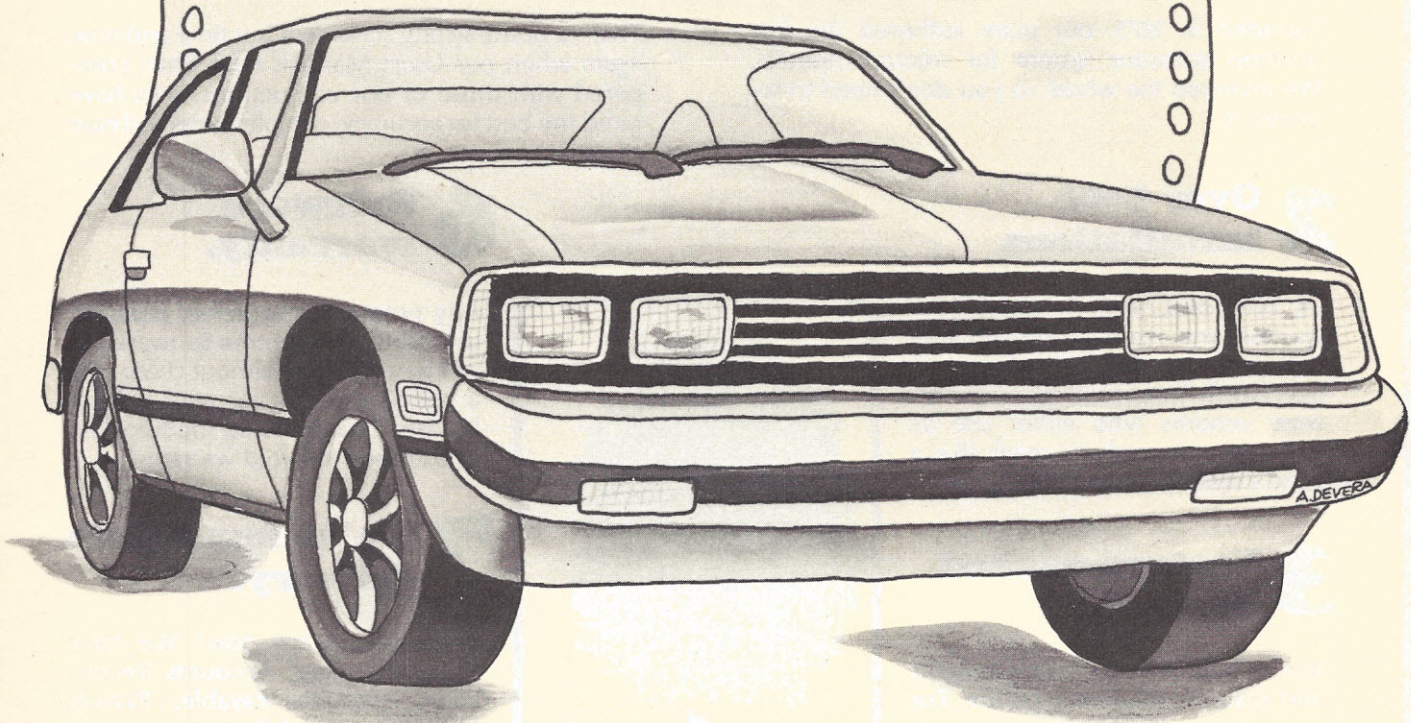
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PROGRAMMING A NEW CAR PURCHASE



—by David D. Busch—

Trading in a used car for a new one is a tradition for most Americans. But with rising inflation, tighter and more expensive credit, postponing a car purchase has become commonplace.

When to buy has become as important as what to buy for cost-conscious car shoppers. It's long been known that depreciation accounts for as much of a car's overall cost as operating expenses such as gasoline or insurance. The bulk of the depreciation takes place in the early years of a car's life, so the relative cost of keeping a present car an extra year is much lower than purchasing a new or secondhand car. Compare/Bas is a program that makes it easy to make a quick comparison between the cost of driving your present car an additional 12 months versus the toll exacted from trading in for a newer automobile.

The program asks for mpg figures, depreciation estimates, registration and insurance costs, and a rough guess as to the projected cost of repairs for the upcoming year. These data vary too widely to be built into a program, and most drivers of older cars can

predict fairly accurately whether such repairs as brake work or exhaust replacements are due.

Compare/Bas totals the operating costs for the coming year for the existing car and its contemplated replacement, and adds depreciation figures supplied by the driver. Again, because depreciation varies so widely from car to car, it is easier for the driver to make an educated guess. A new Corvette may depreciate zero in 12 months; a 10 year old Pinto that's worth \$200 now may still be worth \$200 in a year. Other cars may lose 10 to 30% of their value in that time.

Interest accrued during the next 12 months on loans for either car is included in the figures. For a new purchase, the interest in the early months is hefty. If a balance is still owed on the present car, the interest is likely to be modest.

Compare/Bas provides a printout of each expense category, as well as the total year's expenditure and cost per mile. The actual car payments themselves are not included as an expense. Part of each car payment goes toward the owner's equity and will be recouped

when the car is sold. The year's share of loan interest expense and the depreciation (which is not recouped) are included. No attempt was made to calculate the interest lost from down payments removed from savings, etc. This program is intended as a guide to making a purchase decision only.

Though written for a TRS-80 model I, Compare/Bas uses no unusual Basic features. The program merely asks for the necessary input, and then displays the results of its calculations. Lines 10-190 consist of some initialization "housekeeping," and reading of string data into the necessary arrays. With level II Basic, line 20 is only needed if the programmer wants to save some memory space. Unless a 'dim' statement is used, arrays are automatically dimensioned to 11 elements per dimension (0-10). When less than 11 elements are used in a dimension, memory space is conserved by dimensioning the array to the smaller size.

The basic input to the program is performed in a loop at lines 210-510. The loop is run twice, once for the existing car, and once for its contemplated replacement. Throughout the loop, the variable 'car' serves as a counter to let the program know which element of the various arrays should serve as storage for the data. The final figures are inserted into a two-dimensional array TT(row,column).

True v. estimated values

The present value of the car is input (line 240), and a few lines later (line 290), its estimated value at the end of one year. This produces the depreciation figure. Miles-per-gallon for each car, as well as insurance and

registration costs, are input next. Another loop is nested within the major one to allow the input of any of nine different car repair expenses (lines 460-500).

Information that applies to both cars (cost of gasoline, miles driven) is input in lines 530-560, and the total operating costs calculated in lines 580-650. The results are printed out with 'print using' formatting in lines 680-770.

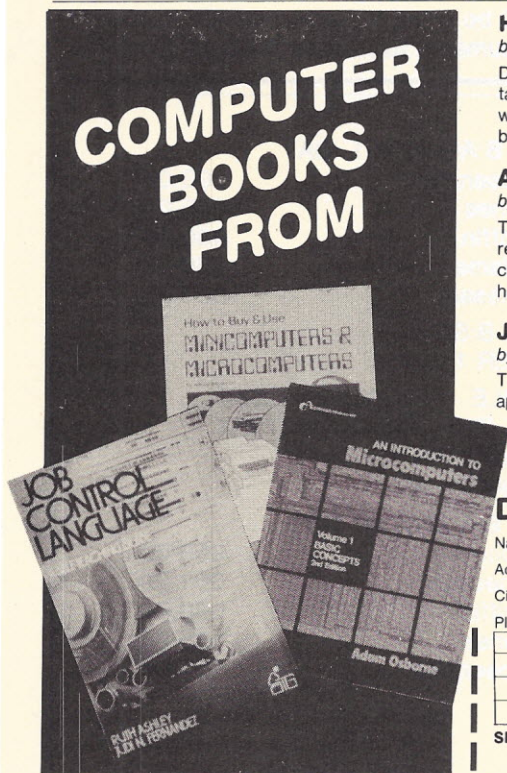
The rest of the program consists of two subroutines that are called from line 260 in order to calculate the interest expense incurred in paying for either the existing or replacement automobile. The user is "allowed" to pay cash for the new car or, in the case of the present car, to have fully paid its loan balance. In either case, the interest expense for the year is zero.

Otherwise the user enters the amount borrowed, interest rate, and total months of the loan. Monthly payment (P(CAR)) is figured using a standard formula at lines 1110-1150.

For an existing car only, the present principal balance is calculated (lines 930-1010), and then the interest that will be paid over the next 12 months or to the end of the loan (whichever is less) is determined in lines 1050-1090. This same routine is used to calculate the first 12 months' interest for a new car with an entry point of line 1030 instead.

Compare/Bas will provide some fairly accurate estimates of cost-per-mile, and total additional expenses of running the old car an extra year versus purchasing a shiny new rig. With solid figures to look at, it's easier to decide if the added merits the new car offers are worth the extra hard dollars-per-month. □

Program on page 148



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BASIC SORT PROGRAM

by William and Alice Englander

In many data processing applications, it is useful to rearrange the records of a file into a different sequence. For example for normal processing, the records of an accounts receivable file might be arranged in customer number sequence.

Number	Name	Amount
0001	Rosenthal	100.00
0002	Jones	025.00
0003	Griffin	030.00
0004	Adams	950.00
0005	Chesser	051.29

A customer list program could best use an input file in name sequence.

Number	Name	Amount
0004	Adams	950.00
0005	Chesser	051.29
0003	Griffin	030.00
0002	Jones	025.00
0001	Rosenthal	100.00

A delinquency follow-up list would be most useful in balance sequence so that customers who owe more than a given amount can be conveniently isolated and pursued.

Number	Name	Amount
0002	Jones	025.00
0003	Griffin	030.00
0005	Chesser	051.29
0001	Rosenthal	100.00
0004	Adams	950.00

The program sorts a file into user-specified sequence. It requests an input file name, an output file name and

the starting position and length of the field in the input records that will be used to sequence the output file (sort key). It assumes a fixed record length input file.

```
A>TYPE B:ACCOUNT. DAT
```

0001	Rosenthal	100.00
0002	Jones	025.00
0003	Griffin	030.00
0004	Adams	950.00
0005	Chesser	051.29

```
A>CRUN B:SORT  
CRUN VER 1.03
```

```
INPUT FILE  B:ACCOUNT.DAT  
OUTPUT FILE B:ACCOUNT.SRT  
KEY START   6  
KEY LENGTH  20
```

```
A>TYPE B:ACCOUNT.SRT
```

0004	Adams	950.00
0005	Chesser	051.29
0003	Griffin	030.00
0002	Jones	025.00
0001	Rosenthal	100.00

```
A>
```

Before and after listings of file being sorted.

The Sort program is written in C-Basic and runs on a 32K Imsai 8080 using CP/M. It is quite simple and can

be easily modified and sophisticated to match your requirements, hardware capacity and software capabilities. Basically Sort reads through the input file, tables in sequence the 100 lowest sort keys and their record locations, reads the corresponding records in sequence and writes them to the output file.

It then reads through the input file again, tables the next 100 lowest keys and locations, reads the corresponding records in sequence and writes them to

The faster the computer the larger the key array.

the output file. It continues to do this until all of the input records have been written to the output file in key sequence.

The primary variable for fine tuning Sort is the size of the key array (M). The faster the computer and software (or the slower the disks), the larger the key array should be (within existing memory constraints). It may be desirable to compute M dynamically after determining the record size (R) in the form $M = (FRE - a) / (R + b)$ where a is the memory needed during the rest of the program execution and b is the overhead per key array element given a particular version of Basic.

Variables and their uses in the program are:

Variable	Use
C	Relative location of input record just read
D	Done switch
I	Work variable
L	Key length
M	Maximum key array size (+ 1)
N	Current key array size
R	Record length
S	Key starting position
B\$	Work string
I\$	Input file name
K\$	Key & record number of current record
L\$	Key & record number of highest record in previous pass
T\$	Array of keys & record numbers

The logic of Sort:

Initialize program

lines 2-7 The name of the file to be sorted is obtained from the user. The first record is read and its length (R) is determined (2 is added for the carriage return and line feed characters present in CP/M files). The subsequent 'open' of the input file will require that the record length be specified since the input file will be read randomly.

lines 8-10 The name of the output file and sort key location are obtained from the user.

lines 11-12 The key array is dimensioned one larger than the actual size to simplify array handling.

Program listing

```

1: REM ***** INITIALIZE *****
2: INPUT "INPUT FILE " I$
3: IF END #1 THEN 10
4: OPEN I$ AS 1
5: READ #1 LINE B$
6: R=LEN(B$)+2
7: CLOSE 1
8: INPUT "OUTPUT FILE " O$
9: INPUT "KEY START " S
10: INPUT "KEY LENGTH " L
11: M=100
12: DIM T$(M+1)
13: FOR I=1 TO L+4: L$=L$+CHR$(0): NEXT I
14: CREATE O$ AS 2
15: REM ***** BUILD KEY TABLE *****
16: WHILE D=0
17:   D=1
18:   C=0: I=0: N=0
19:   OPEN I$ RECL R AS 1
20:   IF END #1 THEN 40
21:   READ #1 LINE B$
22:   C=C+1
23:   K$=MID$(B$,S,L)+RIGHT$("000"+STR$(C),4)
24:   IF K$<=L$ THEN 20
25:   IF N=0 THEN 30
26:   FOR I=N TO 1 STEP -1
27:     IF N>T$(I) THEN 30
28:     T$(I+1)=T$(I)
29:   NEXT I
30:   I=I+1
31:   T$(I)=K$
32:   IF N<M THEN N=N+1 ELSE D=0
33:   GOTO 20
34:
35: REM ***** WRITE OUTPUT FILE *****
36: L$=T$(N)
37: FOR I=1 TO N
38:   C=VAL(RIGHT$(T$(I),4))
39:   READ #1 LINE B$
40:   PRINT USING "0";#2;B$
41:   NEXT I
42:   CLOSE 1
43:   WEND
44:
45: REM ***** TERMINATE *****
46: CLOSE 2
47: STOP
48: END
49:

```

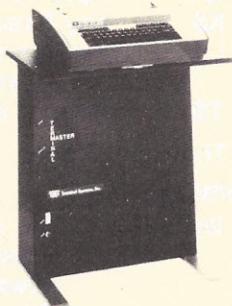

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line 13

The highest key and record number are initialized at lowest possible value.

line 14

The output file is created.

Build key table

lines 17-18

Lines 17 through 44 are executed repeatedly until all input records have been written to the output file in key sequence.

lines 19-21

Variables are initialized and the input file is opened.

lines 22-23

The next input record is read and the record number incremented.

line 24

The key and record number of the input record are established. A four digit record number is used.

line 25

The processing of the record is bypassed if its key is not higher than the highest record already written.

line 26

The first element to go into the key array is special-cased.

lines 27-30

The entries in the key array are pushed down so that the current record key and number can be inserted in sequence.

lines 31-32

The new record key and number are inserted into the array.

line 33

If the key array is not full, its size is incremented, otherwise more passes are indicated (D=0).

line 34

The process is repeated for the next input record.

Write output file

line 37

The highest record key and number are set to last record key and number from the table.

lines 38-42

The records whose numbers are in the array are read randomly and written in sequence to the output file. The "using "&" is specified to prevent C-Basic from including surrounding quotes with the output string.

line 43

The input file is closed.

Terminate program

line 47

The output file is closed.

lines 48-49

The program is terminated.

Enhancements you might want to add:

- Multiple sort keys.
- Descending sequence option, which would have been useful in the sort on amount example. If the balances owed were in descending sequence, the follow-up process could start at the top of the follow-up listing.
- Handle variable length records, e.g., by copying the input file to a temporary file with fixed length records (depends on Basic and operating system).
- Dynamic table size optimization (mentioned earlier).

The current program works very well, yet remains simple (high on our list of desirable characteristics). Happy sorting. □

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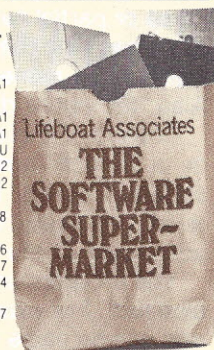
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APRIL 1981

the first attempt at reading the file, I know that it really didn't exist.

In Pathran, the end of file routine sends control to the routine that searches sequentially.

You might be wondering how the index files get created. Listing 2 is a utility program for Pathran. It will create an index file for both the doctors and the pathologies.

Each index file contains records on three fields. There is one record for each doctor or pathology per patient.

The fields are:

1. Doctor or pathology
2. File pointer
3. Record number in the file

This allows random access directly to the desired data. The example shows a list of the pathology index file after it was created by running the index utility program. Note that for each pathology, there is a file pointer and a record number. The file pointer is actually part of the file name (e.g., "A" means "A.dat"). Basic tags on the rest of the file name. The record number is the actual number used in the random access 'read' statement in Basic. For example, assume the Basic statement: 'read #2,inrec;.....'. In this example, if the record number from the index file is, say 5, then inrec would have the value of five. So the 'read' statement would read the fifth record from the second (#2) file that Basic has previously 'opened'. Check out the logic in listing 1.

Problems still crop up

As I said before, no matter how good a program is, it can always be improved on. This program is still nowhere near perfect. For example, I did not handle the problem of maintaining the index files in Pathran when a patient is added to the file. Deletions will be recognized only because of the D in the first field of the record (A means active, — D means deleted). But the index file will still point to the deleted record because Pathran does not update the index file. After many deletions, ISAM will waste time reading deleted records and ignoring them after matching the status field (field one) to a D.

After additions are done, one can run the 'index' utility again to reorganize the index files. This is why I didn't find it necessary to maintain the index file in Pathran. But if additions are done often, this would definitely be necessary.

Another thing that could be improved on is the elimination of redundant data. Now that I have the doctor's names and the types of pathologies in the index files, there is really no need to keep individual records.

Also, depending on the application, it might be advantageous to maintain the index files in alphabetical order.

Anyone interested in taking it further? I have used this program as an example in how improvements can be made. Actually, I have no need for a pathology bookkeeper. But with these modifications, the next step is to change it into a generalized data inquiry system with powerful access method techniques and smart screen layout formats. □

Program on page 152

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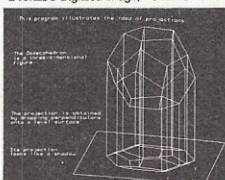
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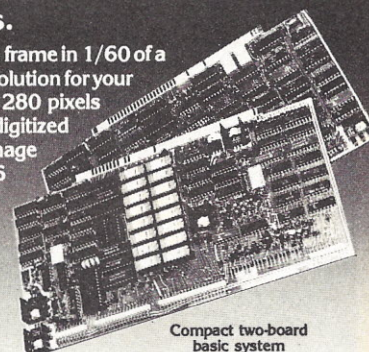
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An ordinary 5 1/4" floppy provides just 35 tracks per side and stores only 70K bytes. This is not nearly enough for anything useful, so instead, Micropolis uses 77 tracks per side. Each track is then formatted with 16 sectors (hard) at 256 bytes per sector yielding an impressive 315K bytes per side.

Micropolis drives have a larger capacity than many 8" disk drives, though it only occupies the space of a 5 1/4" floppy. The 315K byte capacity is roughly 4 times the capacity of a standard 5 1/4" drive. This is what we call QUAD DENSITY.

To achieve the high density capability, you may think Micropolis had to sacrifice speed or reliability. NOT SO! The track to track access time is only 300ns with a high speed data transfer rate of 250,000 bits per second.

By creating this high density format, Micropolis is able to keep your initial subsystem costs to a minimum. Your cost is less than \$.002 per byte. That's a BIG VALUE in a small package.

MICROPOLIS disk subsystems are expandable to keep up with your ever increasing needs. Up to four drives/heads may be daisy-chained on one S-100 controller board. With all four drives/heads in operation, you have access to over 12 MEGABYTES of on-line storage.

WITH MICROPOLIS, complete means COMPLETE. Each subsystem comes complete with controller interface, cable, and software. The software includes the MDOS operating system, extended basic, assembler and editor. Everything you need to get "On Line" in one complete package.

MICROPOLIS provides total integration which means they control everything from beginning to end. The result is a better drive for you, backed by a full 120 day factory guarantee.

Anyone can cut price by cutting out capacity or valuable features. But there's no long term advantage in it. Not for the user. Or the builder.

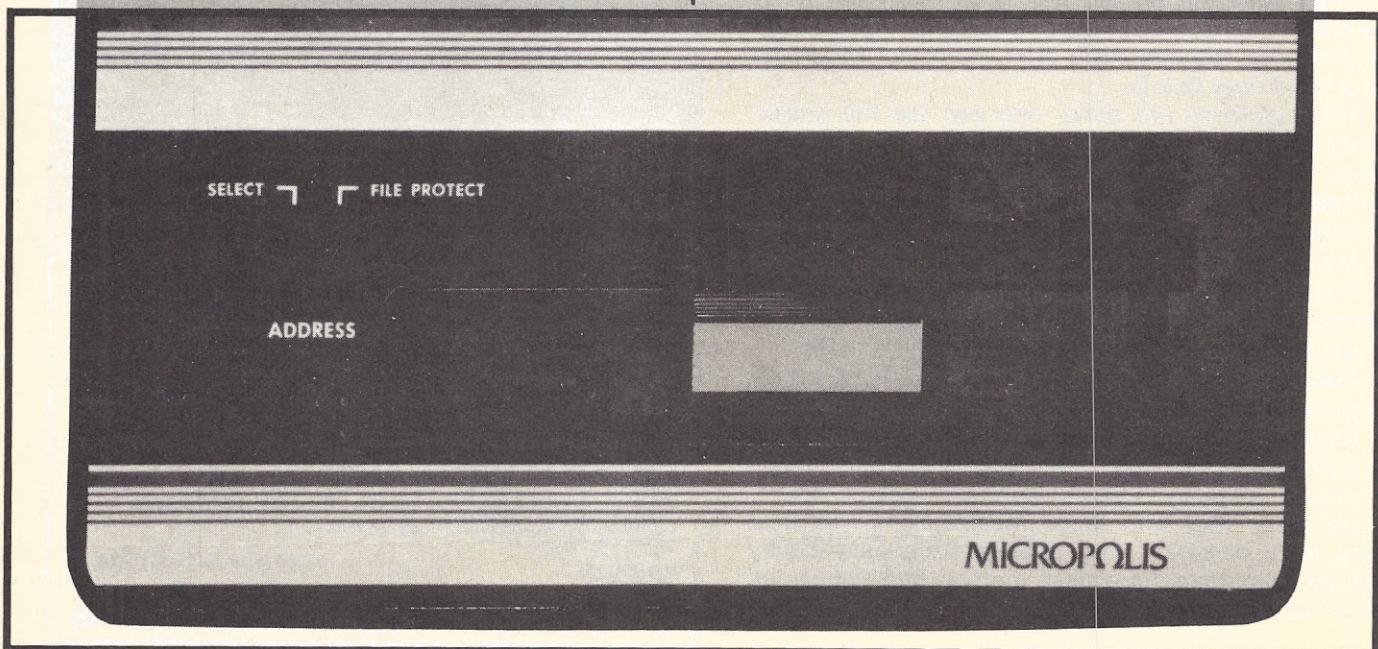
MICROPOLIS takes a better approach, even though it's harder, using advanced design to provide more capability while also lowering cost.

For example, most 5 1/4-inch floppy disks cut costs by using a cheap, less accurate plastic cam or cam follower to position the read/write head. Most 8-inch floppy disks use a better approach, with a rolled steel lead screw for this function.

We go them one better and use an all-steel system, with a precision-ground steel lead screw and steel follower. It costs more but gives us greater storage capacity with lower cost per thousand bytes. Not so incidentally, our steel construction (compared to plastic) significantly increases reliability, too. There's even a built-in File Protect feature that prevents accidental loss of valuable data. (A file protected diskette cannot be written on.)

Heat can cause numerous read and write errors that can become hazardous to your data. The major heat producing power supply components are mounted to a large heat sink, external to the cabinet, by the power switch and fuse (located at the rear of the cabinet). This design is to assure that the drive components are kept as cool as possible to assure reliable data recovery.

MICROPOLIS has a reputation for getting along with most everybody. Compatibility is not a problem with MICROPOLIS. Their disk drives and/or subsystems can be easily integrated into systems such as Polymorphic, Cromemco, CCS, Ithica Intersystems, Godbout, Northstar, Jade Big Z, QT SBC 2/4, and many others. Many OEM manufacturers rely on MICROPOLIS to get the job done efficiently. Companies like Commodore, Exidy, Harris, and Vector Graphics to name just a few. Years from now, you can look back with a secure feeling knowing you made the best choice. MICROPOLIS.

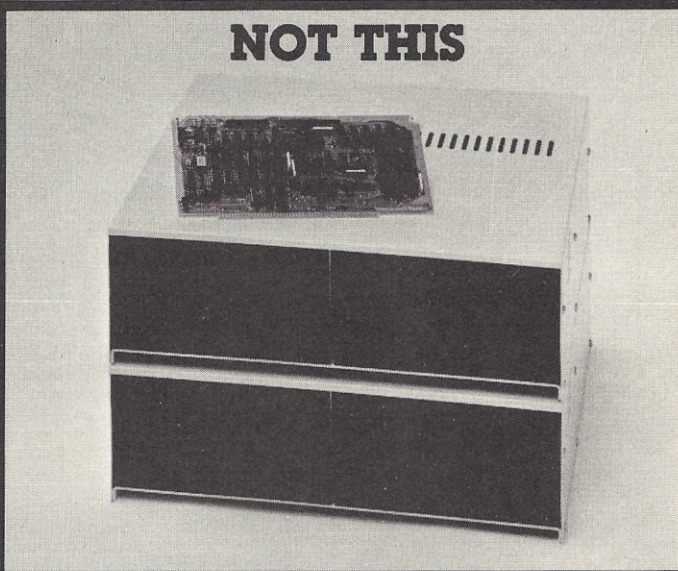


CAPACITY OF AN IN 5 1/4" FORMAT

THIS



NOT THIS



Because of our incredible purchasing power, PRIORITY ONE ELECTRONICS is able to buy MICROPOLIS disk drives by the thousands and receive special pricing. That special pricing we receive is passed on to you in the form of tremendously discounted prices. Now all that remains is for you to take advantage of this truly incredible buy.

MODEL	DESCRIPTION	LIST	SALE PRICE
S-100 SUB-SYSTEMS			
MCP-1053-4	1.2 MB 2 HEAD DUAL	\$2605.00	\$1395.00
MCP-1053-2	630 KB DUAL	\$1895.00	\$995.00
MCP-1043-2	315 KB SINGLE	\$1145.00	\$695.00
MCP-1041-2	315 KB SINGLE, NO PS	\$1045.00	\$639.00
MCP-1042-1	143 KB SINGLE	\$795.00	\$625.00
MCP-1041-1	143 KB SINGLE, NO PS	\$695.00	\$595.00

COMPLETE W/S-100 CONTROLLER, CABLES,
MANUALS AND MICROPOLIS MDOS AND BASIC
ADD-ON DRIVES

MCP-1033-2	630 KB DUAL	\$1395.00	\$895.00
MCP-1023-2	315 KB SINGLE	\$645.00	\$495.00
MCP-1021-2	315 KB SINGLE, NO PS	\$545.00	\$475.00
MCP-1022-1	143 KB SINGLE	\$545.00	\$375.00
MCP-1021-1	143 KB SINGLE, NO PS	\$445.00	\$360.00

REQUIRES ACCESSORY ADD-ON CABLES

GOOD NEWS FOR TRS-80* OWNERS

We now have a complete line of TRS-80* Model 1 compatible MICROPOLIS add on drives in matching colors. These drives simply plug into the expansion interface via a disc data cable.

197K BYTES PER SIDE FOR YOUR TRS-80*, that's easy! Just order a 77 track add on drive and the New DOS-80 operating system. Among the many features of New DOS-80, is its ability to control any mix of 35, 40, or 77 track drives on the same cable.

TRS-80® DISK DRIVES

MCP-1027-1	35 TRACK SINGLE	\$545.00	\$279.95
MCP-1037-1	35 TRACK DUAL	\$1195.00	\$695.00
MCP-1027-2	77 TRACK SINGLE	\$645.00	\$439.00
MCP-1037-2	77 TRACK DUAL	\$1395.00	\$795.00

ACCESSORIES

APP 395M	NEW DOS/80 TRS-80*		
	35 thru 77	SUPPLIED	ON
	TRACK OPERATING	35 TRACK	77 TRACK
	SYSTEM	\$149.00	\$159.00
PR1-34CEEE-2	Two Drive Data Cable		\$29.95
PR1-34CEEE-4	Four Drive Data Cable		\$39.95
	GOOD THRU MARCH 1981		

THIS COULD BE THE START OF SOMETHING SMALL.



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Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax, Minimum order \$15.00 Prepaid U.S. orders less than \$75.00 include 5% shipping and handling. MINIMUM \$2.50. Excess refunded. Just in case ... please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru March 1981.

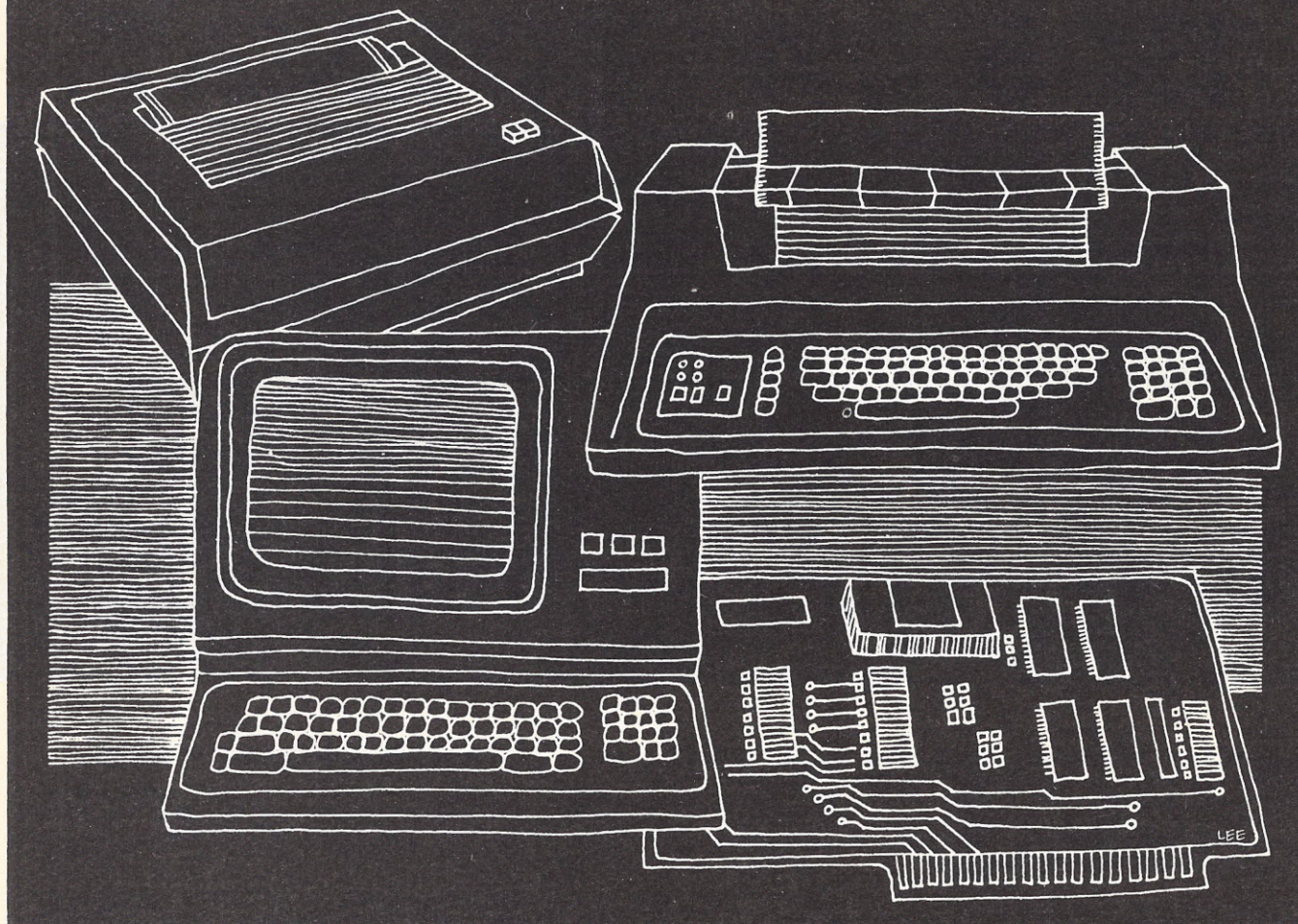
*SOCKET and CONNECTOR prices based on GOLD, not exceeding \$700 per oz.

*Sale Prices are, for prepaid orders only. Credit card orders will be charged appropriate freight

CIRCLE INQUIRY NO. 105

*TRS-80 is a registered trademark of Tandy Corp.

NEW PRODUCTS DIRECTORY



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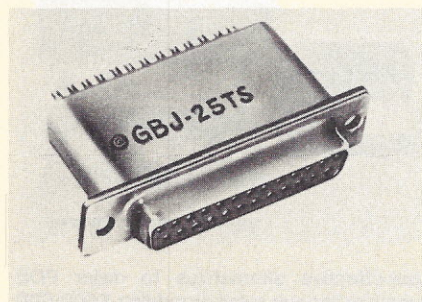
HARDWARE

COMPONENTS/OEM

Edgeboard connector, series 7000, is manufactured in both wirewrap and dip solder versions, and features a plating option of either .000010 in. (.000254mm) or .000030 in. (.000762mm) gold at point of contact. The tail area of the contact can be plated with .000005/.000010 in. (.000127/.000254mm) gold flash, or left unplated. Product options include either a standard or flush insulator configuration; right-angle termination or extender card contacts; and a choice in mounting styles of either the standard ear, no mounting ear, or the #4-40 threaded insert. Contact termination options include .160 by .018 sq. in. (.406 by .046mm) custom short tails, .220 by .025 sq. in. (.559 by .064mm) standard. Features include a wide choice of contact sizes from 10-70 double row; bifurcated bellows contacts; an extra-large chamfered entry; replaceable contacts; and contact polarizing. Price per 500 pieces is \$2.68 at a \$600 gold base. Stanford Applied Engineering, 340 Martin Ave., Santa Clara, CA, (408) 988-0700.

CIRCLE INQUIRY NO. 225

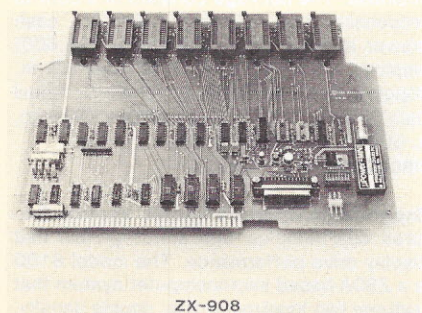
Rack and panel subminiature connectors combine the functions of a "D" subminiature-type connector with low, mid, standard, or high frequency feed-through filters to minimize RFI/EMI problems. Produced in 9, 15, 25, 37, and 50 pin configurations, they meet MIL-C-24308 compatibility requirements. Incorporating rugged soldered



grounds, the connectors can be supplied with 3 types of contacts in any mix: filter, power, or ground. Attenuation is 50 dB min. from 500 to 10,000 MHz, per MIL-STD-220 (no applied voltage or current). General Connector Corp., 80 Bridge St., Newton, MA 02158, (617) 244-5706.

CIRCLE INQUIRY NO. 226

Prom programmer, ZX-908, is available in models to program Intel 2716, 2732 and 2732A Eproms, with the capacity to program

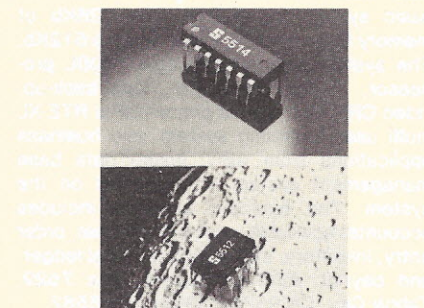


ZX-908

16K bytes of Eprom storage in one operation. Operates within a Multibus chassis with simple software drivers and requires a 5 volt only power supply. Eight Zero-Insertion-Force (ZIF) sockets are provided for quick and safe Prom insertion and withdrawal. Price: \$720. Zendex Corp., 6680 Sierra Lane, Dublin, CA 94566, (415) 829-1284.

CIRCLE INQUIRY NO. 227

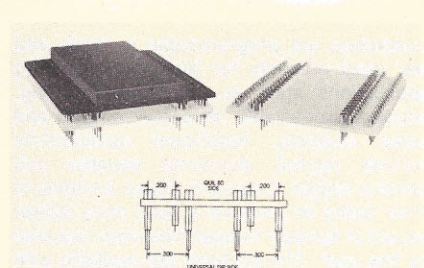
Operational amplifiers offer a complementary dual- and quad-packaged high-quality op amp series featuring extremely high input impedance (100 megohm). The NE/SE 5512 (dual) and NE/SE 5514 (quad) devices offer a significant advantage over run-of-the-mill op amps in critical applications requiring high stability under various closed-loop conditions, such as active filter designs, active integrator, and active differentiator circuits. In addition, they will perform ideally in many instrumentation areas where extremely low bias current (10nA max) and low offset voltage (2mV max)



is a must, such as high impedance transducer applications that formerly required FET input buffering or in current-to-voltage converter. The 5512 is pin-for-pin compatible with industry standard duals, such as the MC 1458 types, and the 5514 is pin-compatible with the LM 124/324. Other features include very low distortion—.01% at 10 kilohertz ($V_o = 7V_{rms}$)—very low inter-amplifier cross-coupling ($-120dB$) and a typical slew rate of one volt per microsecond. Signetics, 811 E. Arques Ave., P.O. Box 409, Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 228

In-line adapter enables hybrid analog modules to mate with universal PC boards. The Quil adapter is designed to provide a con-

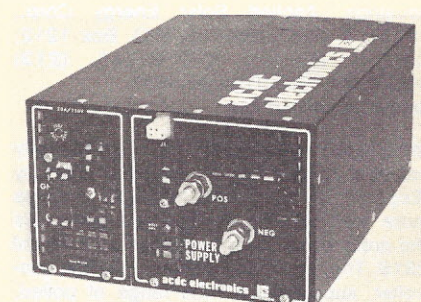


venient, reliable means of converting contact configurations from an 80-position pattern to a standard .300 in. and .600 in. universal in-line spacing. Designated No. 680-Quil-15, the adapter assures positive mating of the hybrid module to a universal PC board through a unique socket receptacle design. The socket features precision Swiss screw

machine contacts with a four-tine beryllium-copper gold-plated spring clip and a gold- or tin-plated brass body which can be supplied with dip solder or wire wrap terminations. The body is laminated glass epoxy, .062 in. thick, which conforms to UL specification 94V2. Garry, Box 94, North Brunswick, NJ 08902, (201) 846-5280.

CIRCLE INQUIRY NO. 229

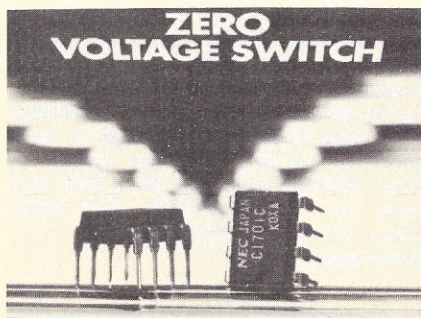
Switching power supplies designated Eagle series are designed for output power and reliability. Up to 3 outputs are available in the 600W configuration and up to 4 outputs in the 750 and 1000W models. The 1500W model is a single output unit capable of up to 400 amps of current. Output voltages of the single output units range from 2 to 28VDC. Multi-output units have a main output of 5VDC with isolated secondary outputs ranging from 2 to 28VDC, producing literally hundreds of output combinations to satisfy most, if not all, customer applications. Current levels of the main and secondary outputs vary depending on total output power of each unit. The series incorporates LSI control circuits mounted on printed circuit boards to form standard modular subassemblies. Each subassembly performs a separate and distinct



function within the supply itself. The subassemblies are joined together by means of an interconnecting strip. Prices begin at \$689 for 600W, \$749 for 750W, \$989 for 1000W and \$1190 for 1500W. acdc electronics, Div. of Emerson Electric Co., 401 Jones Rd., Oceanside, CA 92054.

CIRCLE INQUIRY NO. 230

Zero voltage switch, the μPC 1701C, is designed for controlling triacs in AC power switching applications. The switch is useful for temperature controlled panel heaters, for cookers, or film processing baths. Switching occurs at the zero voltage point in order to minimize rf interference. The output drive triggers the triac in the negative output current pulses up to 250 mA. The 8-pin mini-

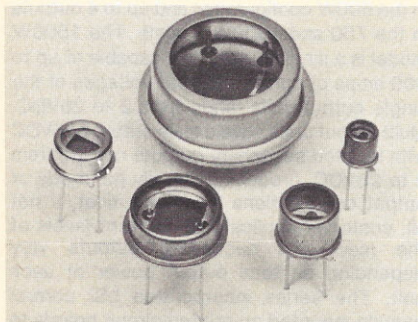


dip operates either through AC or DC power supplies and it requires minimal external components. It can replace the Motorola MC 3370P; the Telefunken V 217B; and the

Plessy SL 445. It is available at \$1.60 each in 100-piece lots. NEC Electron, 252 Humboldt Ct., Sunnyvale, CA 94086, (408) 745-6520.

CIRCLE INQUIRY NO. 231

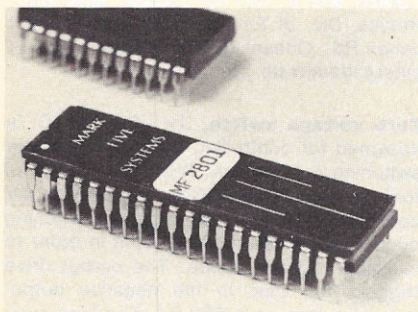
Planar diffused photodiodes, PS series, offers high speed response, linearity over a wide incident power range, and a NEP of 8 by 10^{-14} W/Hz $^{1/2}$. Current applications include fiber optic, process control instrumentation, optical encoders, flash detection, photocopiers, and optical character recogni-



tion devices. They are offered in six active element sizes from 1.0mm 2 to 86mm 2 and are packaged in metal, hermetically sealed housings. Applied Solar Energy Corp., 15251 E. Don Julian Rd., P.O. Box 1212, City of Industry, CA 91749, (213) 968-6581, TWX 910-584-4890.

CIRCLE INQUIRY NO. 232

Integrated controller for electronically erasable programmable read-only memory (Eeprom), the single-chip MF2801, replaces more than 40 TTL devices and generates the precise waveforms required by the Intel 2816. The chip is an intelligent Eeprom controller, supporting a wide range of polled, interrupt-driven or dual-ported memory subsystems. It interfaces directly to a main CPU via an 8-bit standard asynchronous system bus. The controller eliminates system overhead on erasing, writing (programming), and



reading bytes or blocks of 2816 Eeprom data. Operations are fully buffered. Automatic verification and cycle timing are provided for erase, write, and modify operations. Both single-port and dual-port memory systems can be configured, allowing either a minimum component count system design or high-speed access to the memory system for direct program execution. Mark Five Systems, Inc., 836 Fourth St., Box 1819, Ouray, CO 81427, (303) 325-4228.

CIRCLE INQUIRY NO. 233

COMPUTER SYSTEMS

The small one is a complete computer system in a single portable enclosure. Hard-

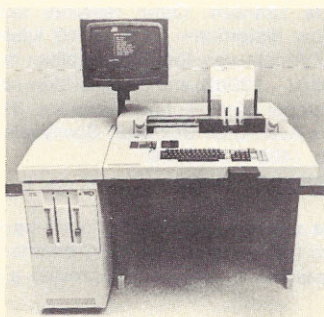
ware versatility of this modular design is assured in part by utilizing the standard IEEE S-100 circuit board chassis. Large libraries of software are available to be used with operating system that is CP/M and Cromemco compatible. The standard starter system includes one 2-80A processor, a 1920 character display format, 48 kbytes of memory, on 5 1/4 inch floppy disk drive (software selectable single or double density), two RS-232 I/O ports, and five vacant circuit board slots. Additional disk drives are also available in individual clip-on cabinets. Storage capacity range in size from 70 Kbytes to 10 megabytes with various formatting software. Optional features include a removable protective plastic display cover for adaptations requiring light pen control or a color CRT, and a switch selectable 110/220V power supply. GMR Inc., 1048 E. Burgrove St., Carson, CA 90746, (213) 639-4663.

CIRCLE INQUIRY NO. 234

1000L computer system is offered with ABC business accounting software. The basic system is shipped with 128Kb of memory that is readily expandable to 512Kb. The system includes the new 1000L processor, 15 Mb winchester, tape back-up, video CRT, high speed printer, HP's RTE-XL multi user operating system, and business applications from ABC. Image data base management system is supported on the system. The business software includes accounts receivable, accounts payable, order entry, inventory, job costing, general ledger, and payroll. ABC Computers, Box 7529, Tahoe City, CA 95730, (916) 583-5562.

CIRCLE INQUIRY NO. 235

Small business computers, the BCS 2030 FV and the BCS 2025 both feature a video display screen and a storage capacity starting at 2 million characters of information. Both



computers are programmable in Basic and are used primarily for general accounting applications such as customer invoicing, accounts receivable, inventory control and sales analysis. Additional applications include payroll, accounts payable and general ledger. Unique to these systems is their ability to produce a hard copy ledger record of account transactions when required by the user. The systems are available with from 2 to 4 high density diskette drives providing a maximum of 4 million characters of information storage (1 million characters per disk). The 2030 can be expanded to 20 million characters of storage through the installation of two 10 MB hard disk units. Both systems incorporate a 1920 character CRT workstation to simplify the overall operation. The screen guides the operator through every step of the program and facilitates inquiry into stored information. There are several hardware differences. The 2030

includes an integrated, 100 characters per second (cps) matrix printer and an 18 inch print line. It can be expanded to hard disk storage. Auxiliary printers, other peripheral devices and data communications capability are available on both units. The 2030 has a base hardware price of \$14,950, while the 2025 base price is \$12,950. Olivetti Corp., 155 White Plains Rd., Tarrytown, NY 10591, (914) 631-8100.

CIRCLE INQUIRY NO. 236

Multi-purpose single printed circuit board incorporates all the functions of a complete computer system. Measuring 10 by 17 inches, the board fits into a small area, does not require a card cage, and requires very little power. It may be operated from conventional power supplies of ± 12 volts or from a battery. The board contains 64K of RAM, 8K Eeprom, 1 asynchronous RS232 serial port, 2 async-sync serial ports (all with programmable baud rates), parallel keyboard port, centronics style printer port, 5 timers, up to 64 parallel I/O lines for general use or hard disk interface, 4 programmable timer/counters, clock/calendar, 4 DMA channels, floppy disk controller for mini or maxi drives, and a video controller. Data World Inc., 8061 Watson Rd., St. Louis, MO 63119.

CIRCLE INQUIRY NO. 237

Computer-electronic cash register can be configured into virtually any retail environment for a minimal investment. RDS Mod II and Mod III systems are developed to be

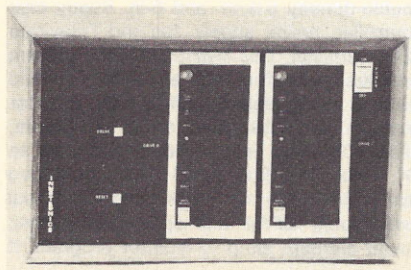


cost-effective alternatives to major POS suppliers for any retail firm doing \$500,000 or more in sales a year. The uniqueness of the system is its machine-language Register software. In addition, menu-driven transactions are modular and integrated, subsystems are on-line and interactive. Another advantage is the ability to be configured to whatever the user requires—be it soft goods, hard goods, liquor, grocery or other store—without purchasing additional equipment. The self-contained check-out line hardware not only serves as a cash register which captures data but also does the back-office data processing prior to opening the next day of business. The package consists of a control processor unit, document printer, cash drawer and software. The Mod II (\$6,500) employs a TRS-80 64K RAM, dual 5 1/4-in. floppies, two-port Radio Shack CPU. Retail Data Service, 160 W. Burton Place, Chicago, IL 60610, (312) 787-6755.

CIRCLE INQUIRY NO. 238

Expandable microcomputer system features dual floppies with status panels that display drive performance. The model 6100 is a Z80A-based microcomputer system that features two Innometrics 8-in. double density,

floppy disk drives with six status indicators each to verify major functions, while aiding operation, programming, and debugging. Disk capacity is 1 million bytes (IBM format, double density), and main memory provides a 64K byte capacity. Each drive has a write protect switch, and two additional disk drives can be added at any time. The model is compatible with the CP/M version operating

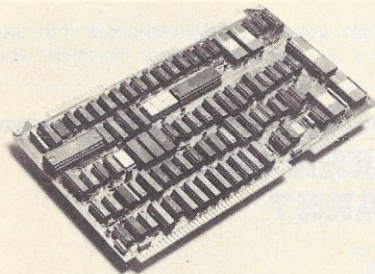


system, IBM 3740 single-density format, IBM 2D double-density format, S100 bus (IEEE standard), and RS232C. Four slots in the backplane can accept modems, graphics, additional I/O and memory. The 10 in. H by 17 in. W by 21½ in. D rack or desk mount system is optionally available with solid walnut or cherry wood enclosure. Price: \$4,950. Innotronics Corp., Brooks Rd., Lincoln, MA 01773. (617) 259-0600.

CIRCLE INQUIRY NO. 239

Single-board computer features extensive memory-management capabilities. This multibus-compatible board features an Am8085A-2 CPU with 4MHz operation. Standard features include two RS232C serial

ports, 24 parallel I/O lines, up to 4K bytes of Prom space, eight-channel vectored interrupt controller and the Am9513 with its five independent 16-bit counters and multimode operation. The versatile memory management unit utilizes a programmable on-board mapping RAM that enables the user to address 256K bytes anywhere in a one megabyte address space. Plus, this ¼ megabyte can be divided into as many as 256 1K-byte segments with each segment independently placed anywhere in the one megabyte address space. Furthermore, each segment can be independently read or write protected. Since the unit provides all the memory management and mapping

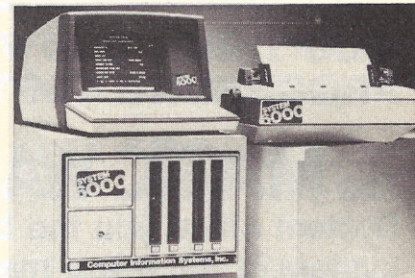


capabilities, the user can select from any RAM board on the market that is multibus compatible. Standard memory boards can be mixed in any combination up to 256K bytes of memory. For example, two Am96/1128 boards, two Am96/1064 and one Am96/1128, etc. The unit is ideal for multiuser/multitasking designs because it allows four independent groupings and common blocks of memory within the memory map. In a

system/user configuration, each user and the system have their own separate address space with only the system allowed to execute I/O operations and similar privileged instructions. When the unit recognizes one of these instructions from the user, it transparently traps that instruction to the system for execution. Depending on the sophistication designed into it by the user, the system can keep track of resource availability to prevent contention problems, resource hogging and to determine priorities of access. Price: \$995. Advanced Micro Devices, 901 Thompson Pl., Sunnyvale, CA 94086, (408) 732-2400

CIRCLE INQUIRY NO. 240

Practice management computer designed for doctors, system 6000, features speeding up receivables, controlling expenses, improving physician productivity and handling



paperwork. Practice management capabilities include receivables aging reports, receivables patient status list, receivables day sheet, patient statements, AMA and Blue Cross/Blue Shield insurance forms, practice



Send for
FREE CATALOG!



M-477



BUSINESS CONTROL PROGRAMS

FROM THE ORIGINATOR OF THE TRS-80® PROJECT



5280 TRAIL LAKE DR.
SUITE 13
FT. WORTH, TX. 76133
(817) 294-2510



THE PASCAL/MT^{AS LOW AS} \$250.00

- Compiler executes under the CP/M operating system in as little as 32 K bytes of RAM
- Interactive Symbolic Debugger which enables the programmer to examine variables, set a breakpoint, and trace procedure calls interactively at run time
- Compiles at the rate of 600 lines per minute on a 2 MHz 8080
- Programs Execute up to 10 TIMES FASTER than popular interpretive Pascals
- The code generated is 8080 object code which is ROMable with a minimum run time overhead of 1.5K bytes
- Interrupt procedures allow the pro-

- grammer to write interrupt drivers for I/O and other real time tasks in Pascal/MT
- Bit manipulations of variables may be performed with the built-in procedures: SETBIT, CLRBIT, TSTBIT, SHL, SHR, SWAP, LO, HI.
- Assembly language subroutines may be called from Pascal/MT
- Business arithmetic version of Pascal/MT is also available
- Pascal data structures supported are: ENUMERATION AND SUBRANGE TYPES, RECORD, ARRAY, REAL, INTEGER, CHAR, and BOOLEAN
- Not implemented are: SETS, GOTO, GET, PUT

CP/M® 2

- Enhanced Upward Compatible File System
- Powerful New Random Access Capabilities

FMG Corporation now offers the CP/M 2.2 for the TRS-80 Model II. From minidisks, floppy disks, all the way to high-capacity hard disks, the flexibility of CP/M 2.2 makes it a truly universal operating system. The package includes an 8" system disk, editor, assembler and debugger for the TRS-80 Model II.

AS LOW AS \$200.00

BUSINESS

- General Ledger
- Payroll
- Accounts Payable
- Accounts Receivable

These business systems are designed with the business manager in mind! Totally screen oriented, they give complete user prompting as each entry is required. Major changes in your current book-keeping method are not necessary to make these programs work for you.

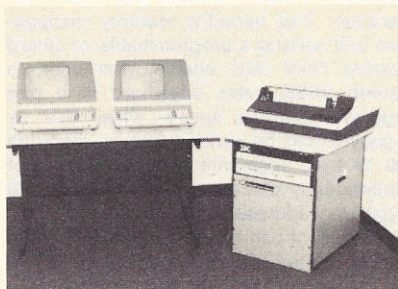
AS LOW AS \$250.00

CP/M is a registered trademark of Digital Research Corp. TRS-80 is a registered trademark of Radio Shack

analysis reports and patient recall reports. The system also handles accounts payable, general ledger/financial statements, payroll, check-writing and word processing. Prices for the basic model begin at \$13,500, or about \$295 per month. Extra hardware and memory capacity is available. Computer Information Systems, Inc., 20 E. Main St., Mesa, AZ 85201, (602) 834-8958.
CIRCLE INQUIRY NO. 241

Small business microcomputer, IBC Ensign, features: Winchester disk drive capacities of 14, 40, 70, 150, and 300 Mbytes/disk in a 7-in. high rack mountable package; both 17 MB tape cartridge and 46 Mbyte reel-to-reel IBM compatible tape drives; up to 256K bytes memory, bank selectable at any size from 4K to 64K/bank; up to ten serial I/O ports for any combination

of ten CRT/printers; intelligent buffered serial I/O controlled by separate micro-processor; hard disk data transfer capability



at disk speed (1 Mbyte/second) into any active or inactive memory partition; and

6MHz processor clock rate. All of these capabilities are handled by one single board computer. Integrated Business Computers, 22010 S. Wilmington, Suite 306, Carson, CA 90745, (213) 518-4245.
CIRCLE INQUIRY NO. 242

16 Megabyte storage capacity is possible in the QT System+. The system includes mainframe, two 8-in. disk drives, double-sided double-density 5¼-in. and 8-in. floppy disk controller, power supply, fan and Televideo 920C terminal. This 4MHz/Z80/CPU system includes such features as: 48K dynamic memory (expandable to 64K); 2K monitor program and Disk Bios on 2716 Eprom; RAM/ROM/Prom in any combination up to 8K; two RS-232C serial I/O ports; two parallel I/O ports; hard disk compatible; real time clock; CP/M 2.2 operating system; power-on/reset jump to monitor program. It

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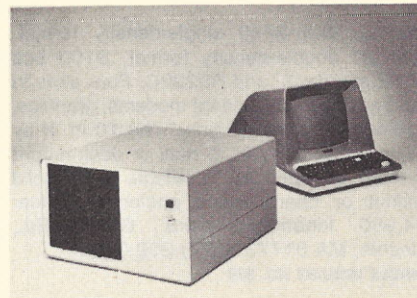
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is designed for both businessmen and engineers. Among other functions, it can be used for accounting and word processing, as well as a variety of scientific applications. The one megabyte single-sided, double-density system sells for \$4,295, while the two megabyte double-sided, double-density unit is priced at \$4,995. The units are assembled, tested and burned in at the factory. Each system includes documentation and has a one year warranty against defects in material and workmanship. MarketPlan, 1020 Pacific Ave., Manhattan Beach, CA 90266, (213) 374-5320.
CIRCLE INQUIRY NO. 243

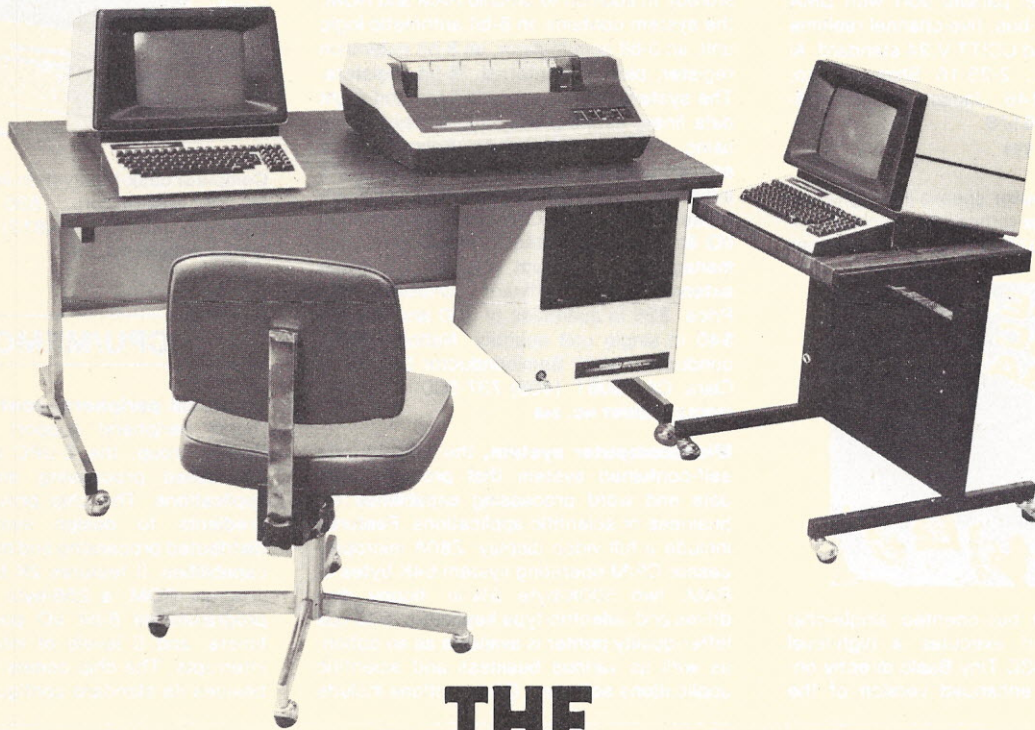
Small business computer, model ABC-26, is the largest memory storage version among the ABC-20 series. ABC-26 consists of Z80A microprocessor, 64K byte standard RAM, floating point arithmetic processing hardware, separable keyboard, 12-in. CRT screen, 8-in. dual floppy drives, two serial



I/O ports, twin-channel port, IEEE 488 bus, etc., with a complementary peripheral support including up to 1 megabyte RAM extension. Main features are the three powerful operating systems including Ai's original Dosket-20, and CP/M and UCSD Pascal, and variety of usable high level languages in-

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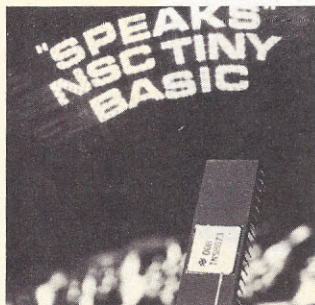
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cluding Basic-80, MBasic, Cobol-80, PL/3, Fortran IV, CBasic, Macro ASM, Pascal plus XASM-Z8000, Xloader-Z8000 and Xmacro-86, etc. Specifications include: CPU Z80A (4MHz), 12-in. green CRT screen, 8-in. dual standard floppy disk drives (2.3M bytes in total, up to 4 drives), 64K RAM (standard; expandable up to 1M bytes), 4K ROM, APU hardware, 101 full keys (Ascii with Euro language capability), two RS-232-C serial ports, twin-channel parallel port with DMA access, IEEE 488 bus, five-channel realtime clock, interrupt and CCITT V.24 standard. Ai Electronics Corp., 2-28-16 Shimomaruko, Ohta-ku, Tokyo 146, Japan. Tel. 03-756-4111, Telex 246-6176.

CIRCLE INQUIRY NO. 244

8-bit microcomputer speaks in a high-level Basic-like language rather than machine language. The INS8073 is the newest member



of the series 70 bus-oriented single-chip 8-bit devices and executes a high-level language called NSC Tiny Basic directly on-chip. This is an enhanced version of the

Basic language, an interpretive language that resides in 2.5K bytes of ROM contained within the system. Because external memory is eliminated, system package count and interconnect are reduced significantly, resulting in a less expensive, more reliable system. The 40-pin system incorporates both on-chip RAM (64 bytes of scratchpad memory) and on-chip ROM (2.5K bytes on which the NSC Tiny Basic interpreter is stored). In addition to on-chip RAM and ROM, the system contains an 8-bit arithmetic logic unit, an 8-bit accumulator, an 8-bit extension register, plus four internal 16-bit registers. The system has 16 address lines and eight data lines, allowing easy system expansion using standard peripherals. Separate read and write strobe outputs from the INS8073 indicate when valid input/output data are present on the 8-bit data bus. The remaining I/O lines are dedicated to initialization, bus management, interrupt request, I/O cycle extension, and software controlled I/O. Price: \$26 in quantities of 100 and up, and \$40 in single unit quantity. National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.

CIRCLE INQUIRY NO. 245

Microcomputer system, the MT500, is a self-contained system that provides both data and word processing capabilities for business or scientific applications. Features include a full video display, Z80A microprocessor CP/M operating system 64K bytes of RAM, two 500K-byte 5¼-in. floppy disk drives and selectric-type keyboard. A 45 cps letter-quality printer is available as an option, as well as various business and scientific applications software. Other options include

higher speed printers and integral 103- or 212A-compatible modems. Available both as a desk top unit and in OEM configurations.



Complete desk-top system lists for less than \$6,000. Maatra Corp., 1835 W. Shryer Ave., Roseville, MN 55113, (612) 631-3555.

CIRCLE INQUIRY NO. 246

CPU/MEMORY

Universal peripheral controller chip, the fourth peripheral support circuit in the Z8000 group, the Z-UPC is designed for distributed processing and multitasking applications. The chip provides all the ingredients to design systems requiring distributed processing and message-passing capabilities. It features 2K bytes of internal program ROM, a 256-byte register file, 3 programmable 8-bit I/O ports, 2 counter/timers, and 6 levels of internal prioritized interrupts. The chip comes in four versions besides its standard configuration: a 64-pin

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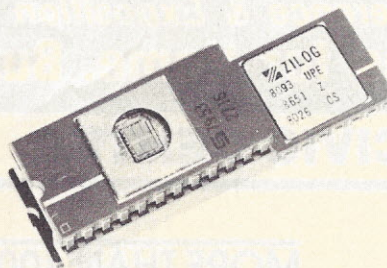
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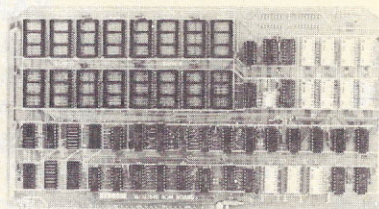
development version (Z8091) with external interface for up to 4K bytes of ROM; a 64-pin version (Z8092) with external interface for up to 4K bytes of RAM that can be downloaded from the master CPU; a 40-pin protopack version (Z8093) with a socket for



up to 2K bytes of ROM; a 40-pin protopack RAM version (Z8094) with a socket for up to 2K bytes of RAM which can also be downloaded from the master CPU. Price is \$117.36 each in quantities of 10-99. Zilog, 10340 Burbank Rd., Cupertino, CA 95014, (408) 446-4666.

CIRCLE INQUIRY NO. 247

PROM/ROM board, Syscom 2106 is a Multibus compatible card having space for up to 64K bytes of Prom or ROM. The board is functionally compatible with Intel Corp.'s iSBC 464 board, with the additional capability of accommodating two types of 32K Proms: the 2732 and the 2532. The board adheres to the Multibus standard and is intended for use with iSBC and BLC products, including the Intel 86/12 microcomputer board. Addresses up to 1 Mbyte may be used, and

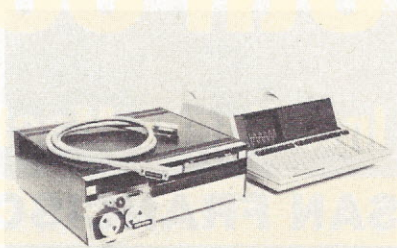


the Prom banks may be configured in any one of the 16 possible 64K pages. The board may be operated in the 8-bit mode or the 16/8-bit mode. Price: \$495. Syscom, 470B Lakeside Dr., Sunnyvale, CA 94086, (408) 736-7320.

CIRCLE INQUIRY NO. 248

Magnetic tape peripheral software and hardware are compatible with the Hewlett-Packard 85 series computer. The model GPIB-3000 is a low cost, digital mass storage system that reads and writes ANSI (x3.56 Standard 1977) ECMA and ISO compatible 1/4-in. digital cartridge (DC 300 and XL) using intelligent and variable file structures. The recorder provides a means of mass storage for approximately 3.35 million bytes of data per movable DC 300XL cartridge. This reliable and easy to use cartridge drive is available in table top or rack mount configuration. The built-in microprocessor controller supports 3 additional slave drives via a dual buffer front-end. Average transfer rate between the HP-85 and the cartridge drive is approximately 6K bytes per second. The computer

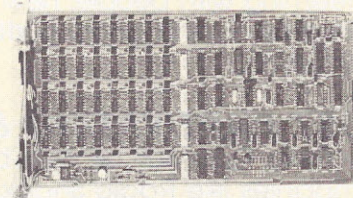
requires the optional I/C ROM and 82937 HP-IB interface card to operate with IDT model GPIB-3000. Prices start at \$4,080 for



a single drive subsystem. Dual drive is priced at \$5,580. Gary Pyles, Innovative Data Technology, 4060 Morena Blvd., San Diego, CA 92117, (714) 270-3990.

CIRCLE INQUIRY NO. 249

64K memory for the H8, model M-H8, is a single-card device using 4116 dynamic RAM. It features transparent refresh; the internal



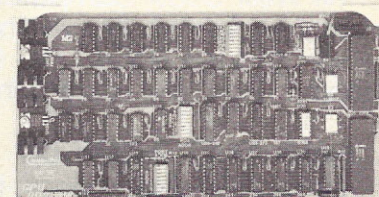
refresh clock holds memory data during processor halt. Price: \$500 assembled, without IC sockets; \$415 kit, with IC sockets. Trionyx Electronics, Inc., Box 5131, Santa Ana, CA 92704.

CIRCLE INQUIRY NO. 250

Hard/soft disk system (HSDD) for the TRS-80 model II includes compatibility with existing programs; access to floppy and hard disk files interchangeably; improved dynamic file allocation; single file that can be as large as one disk—5-, 10-, 20-Mbytes; a directory that can be expanded by the user to handle thousands of files if needed. Floppy or HSD files can be copied from one device to another, including multiple-file copies and powerful select options. Price: \$400. Racet Computes, 702 Palmdale, Orange, CA 92665.

CIRCLE INQUIRY NO. 251

S-100 CPU board, 8085/88 includes two processors that exchange tasks to best



utilize existing system capabilities. One CPU, the 8088, is an 8-bit bus version of the

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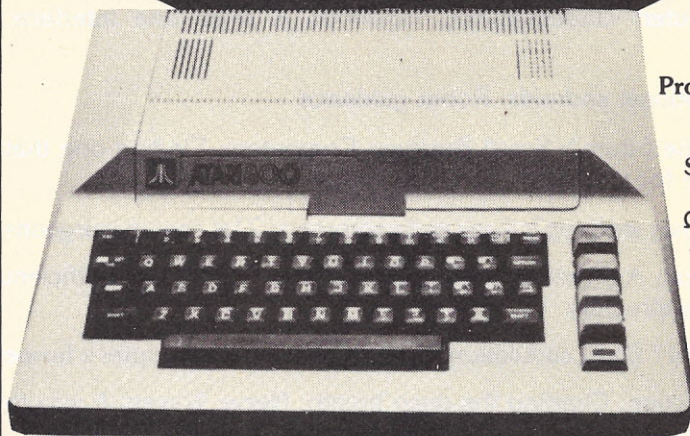
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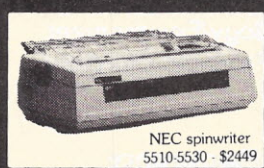


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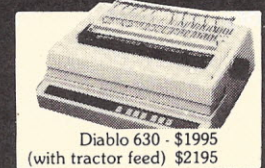
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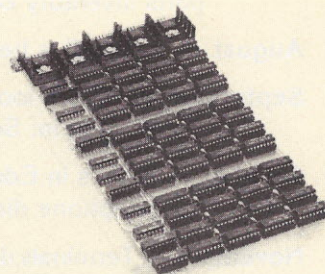


CIRCLE INQUIRY NO. 56

8086 16-bit CPU; it has full 16 bit internal architecture, but interfaces with memory and I/O over an 8-bit bus. The approach ensures compatibility with present day machines while providing the speed and power of a true 16-bit computer. The second CPU (an 8085) is a sophisticated 8-bit processor that can run existing software such as CP/M, and may optionally run at 2 MHz for compatibility with timing dependent software. Prices: assembled/tested, \$425; qualified under the high-reliability Certified System Component program, \$525. Compupro, Bldg. 725, Oakland Airport, CA 94614, (415) 562-0636.

CIRCLE INQUIRY NO. 252

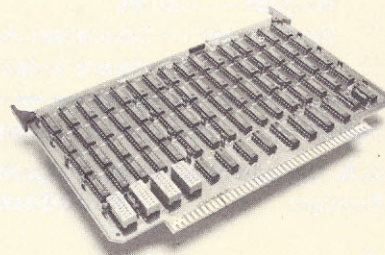
Static RAM card, M24SS, for SS-50/SS-50C bus computers is available in 8, 16 and 24K-byte configurations. An 8K-byte RAM kit features a complement of 17 RAM chips (8.5K bytes of RAM) plus sockets and other components available for expanding the 8 and 16K-byte versions. The RAM card may be strapped to reside in any of the sixteen



64K-byte zones of extended 1M-byte memory space; organized in 8K-byte segments that may be located (via strapping) at any 8K-byte boundary of a 64K-byte memory space; uses the industry standard 2114 static RAM chip. Access time is 300 nsecs (maximum); it is supplied assembled and fully burned-in. Prices for RAM card range from \$199.95 to 499.95. Percom Data Co., 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE INQUIRY NO. 253

32K static RAM module, the 9629, is configured as four individual 8K blocks. Each block can be selected by an on-board switch to operate at any 8K boundary. The module operates from a single +5 VDC supply and requires approximately 2.0 amps. The maximum access time is 450 nsecs. Available also as the 9629A, with 200 nsec maximum



access time. Partially populated versions of the 9629/9629A modules are available for use in smaller systems. The unpopulated device portions on these modules are clear of solder to permit system memory expansion by the addition of the missing devices.

Single quantity price is \$695. Creative Micro Systems, 11642-8 Knott St., Garden Grove, CA 92641, (714) 898-9669.

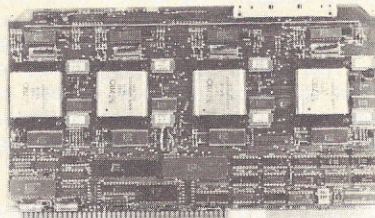
CIRCLE INQUIRY NO. 254

Cartridge modules for use with the Phoenix-type cartridge module drives, CMD-16, are removable, high-density, single-disc data storage cartridge modules providing 16M-bytes of unformatted storage capacity. There are 384 tracks-per-inch and 6048 bits-per-inch with 808 data tracks and 15 alternate tracks. Compatible with Honeywell, Prime, Wang and Ampex Phoenix-type cartridge module drives. A recessed handle in the top cover aids in handling the cartridge. The removable bottom cover protects the cartridge against contamination when it is not in the drive. The covers are designed to interlock to allow cartridge stacking. Price is \$295 in quantities less than five. Memorex Corp., San Tomas at Central Expressway, Santa Clara, CA 95052.

CIRCLE INQUIRY NO. 255

Multibus bubble memory board combines up to 512K-bytes of storage capacity with an interface for multibus systems. The iSBC 254 board offers nonvolatile bubble memory with all support chips on one board, and is designed as a highly reliable storage system for applications requiring nonvolatile memory, high data integrity, tolerance to harsh environments or rough handling and ease of operation. The board contains the IM 7220 bubble memory controller for operation in direct memory access, interrupt and polled modes. The DMA feature provides maximum

flexibility in microprocessor-based system designs. The controller features built-in power-fail protection and error correction. Up to four 1-million-bit bubble memory devices operating in parallel are on the board. Thus, capacity is available in 128, 256 or 512 K-bytes. The board is the standard 12-in. by 6¼-in. card format. The board depth is 0.62 inches, requiring two normally spaced card slots for adequate mechanical clearance. Price of the 512 K-byte board in

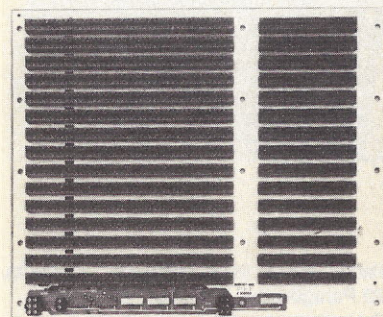


100-unit quantities is \$7,050. The Q-3 in lots of 100 will be \$4,625 while the Q3 1982 price in 1,000 quantity will be \$2,400. Intel Corp., 1302 N. Mathilda Ave., Sunnyvale, CA 94086, (408) 734-8102.

CIRCLE INQUIRY NO. 256

Multibus mother board can accommodate up to 15 cards. Both P1 and P2 are provided at each card position and connectors for the power supply and reset are included. Wiring

is done for a serial daisy-chained bus priority resolution circuit with points available for parallel priority resolution. The top of circuit board is a ground plane to reduce noise on the bus, and the .125-in. thickness provides



added strength. Central Data Corp., 713 Edgebrook Dr., Champaign, IL 61820.

CIRCLE INQUIRY NO. 257

8/16-bit memory board, MB10, featuring extended addressing and protocol, follows and supports the proposed IEEE S-100 bus standard. Extended addressing allows the use of multiple boards in the same configuration with as much as 16 M-bytes of memory. For those applications requiring bank switching, the board is jumper selectable to any I/O address with enable/disable on power-up or reset. Automatic 16-bit request and acknowledge protocol allows mixing 16-bit and 8-bit microprocessors in the same mainframe. The board uses the popular, low power, 2114L memory chip, but the on-board

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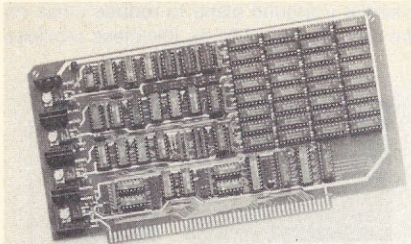
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logic is designed to upgrade easily to the use of faster memory chips as they become



available. SSM Microcomputer Products, 2190 Paragon Dr., San Jose, CA 95131.
CIRCLE INQUIRY NO. 258

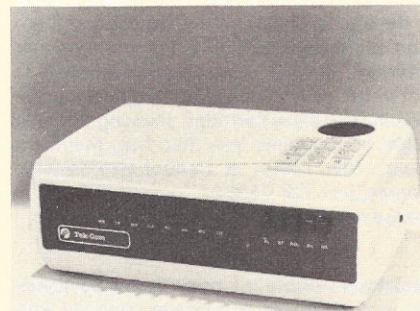
DATA COMMUNICATIONS

Electronic data reporting system is designed for in-store use by retail chains with centralized computer information processing. Retail Administrative and Merchandising System combines sophisticated hand-held terminals, resembling calculators—to collect the data in the store and transmit it by telephone to a central computer—and a wide range of new MSI developed retailing programs resident in the terminal which can be used, or adapted, by virtually any type of department, variety or specialty retail chain. The system can be programmed to perform an almost unlimited number of different in-store data collection functions, ranging from cash register sales reporting

and merchandise inventory tracking and ordering, to payroll information reporting and price audits and updates. MSI Data Corp., 340 Fischer Ave., Costa Mesa, CA 92626, (714) 549-6000.

CIRCLE INQUIRY NO. 265

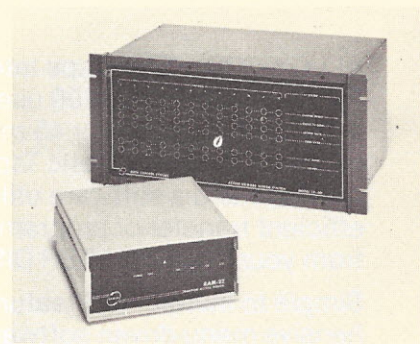
Bell 212A modem replacement, TC2121, is designed to optimize full duplex transmissions of data at either 300 or 1200 baud, over switched networks. Design and operational features include: compatible with Bell 212A modems and 103/113 series; auto-answer and manual originate/answer; micro-



processor controlled; FCC registered for direct connect; full duplex operation over dial-up network; four local and remote test features; visual diagnostic indicators; and asynchronous or synchronous operation. Price: \$849. Tek-Com Inc., 2142 Paragon Dr., San Jose, CA 95131, (408) 263-7400.

CIRCLE INQUIRY NO. 266

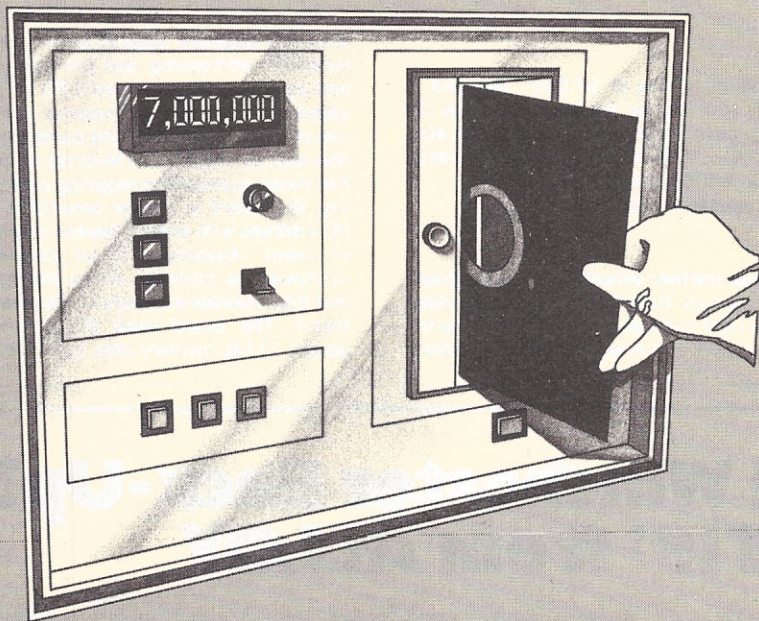
Synchronous wireless modem, RAM-22, utilizes advanced carrier current techniques to reliably transmit digital information over AC power lines. The modem operates at strap selectable speeds of 2400, 4800 or 9600 bps. Up to 12 independent full duplex channels can exist using a building's AC wiring as the transmission line. Each channel



is separated in the frequency domain and can be used in a point to point mode or be multidropped under protocol control. Data-Control Systems, Commerce Dr., Danbury, CT 06810, (203) 743-9241.

CIRCLE INQUIRY NO. 267

Demon dialer frees you from the annoyance of dialing and redialing. While most automatic dialers can only redial a busy number once, this one dials repeatedly on command, and keeps dialing until it gets through. When it reaches your party, it sounds a tone to tell you that your call is ready. And all the while it's dialing, your phone stays open to receive calls. There are two members of the family, Demon and



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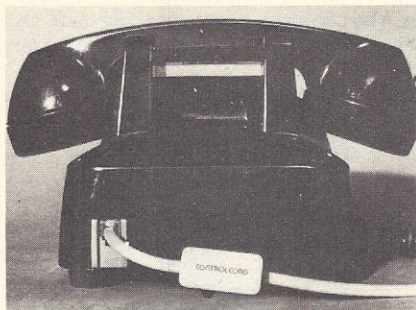


wabash

Wabash Tape Corporation 2700 Des Plaines Ave., Des Plaines, IL 60018 800-323-9868
312-298-8585

CIRCLE INQUIRY NO. 80

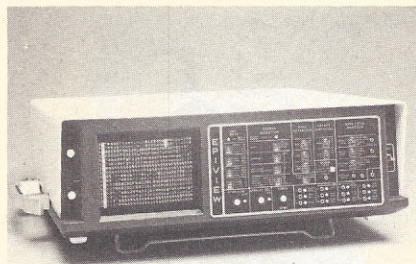
Super Demon. Demon will remember up to 10 numbers, and dial them with a single digit.



Super Demon stores 93 numbers by name. Zoom Telephonics, 122 Bowdoin St., Boston, MA 02108, (617) 523-6281.

CIRCLE INQUIRY NO. 268

Data communications analyzer for byte-oriented protocols, includes eight pages (4096 characters) of refresh memory. The Epiview model 120 contains a 5-in. CRT display and may be used to drive external displays in tandem with the integral tube. Users may view synchronous, asynchronous or isochronous communications in Ascii, Ebcdic, hex pairs, EBCD, Baudot, Ipars or other optional sets. The model can be programmed to stop for parity/framing errors, for a user selected detect character or for designated external events. 12 standard bit



rates (50 to 9600 bps) are available, together with four customer-selected nonstandard rates. The refresh memory can call up as many as eight pages of data for detailed analysis after real-time viewing has ended. Epicom, 592 N. Douglas Ave., Altamonte Springs, FL 32701, (305) 869-5000.

CIRCLE INQUIRY NO. 269

Direct connect modems, Microconnections, interface most popular computers and terminals to the telephone network. Units feature Bell 103 compatible operation in the originate or answer mode. A direct connection to the telephone line eliminates the problems associated with acoustic coupled modems and provides high sensitivity, low error rates and noise free performance. The TRS-80 connection interfaces directly to the model I and PMC-80 data/address bus to decode RS-232 information. It can be connected directly to the keyboard, which eliminates the need for the expansion interface or serial I/O RS-232 board. The RS-232 connection plugs into the standard DB connector. It provides replacement for obsolete acoustic coupled devices and can be used with virtually any computer or terminal with provision for RS-232 serial I/O at 300 baud. The Atari connection interfaces directly with

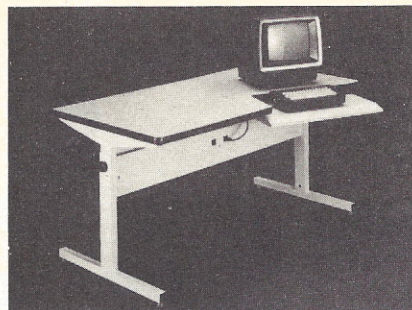
the data I/O cable and connects in series with the 400 or 800 and cassette or disk drive. The Microconnection for the Apple employs a plug-in card to accomplish bus decoding and supplies an RS-232 compatible signal. An option allows the modems to be used with European systems (the European connection). Tone frequencies are set to CCIR standards. Prices start at \$200. MicroPeripheral Corp., 2643 151st Place N.E., Redmond, WA 98052.

CIRCLE INQUIRY NO. 270

FURNITURE

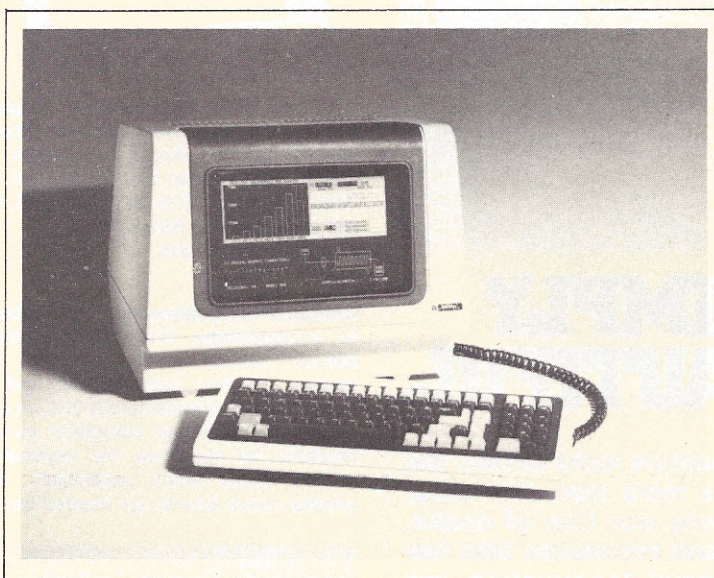
Multiple function work stations are designed for CRT/VDT word processing

terminals as well as providing clerical work area. The line has an almost unlimited choice of sizes as well as a number



of options of flat tops, dropped keyboards, angle offset keyboards, etc. The units are sturdily constructed to take the

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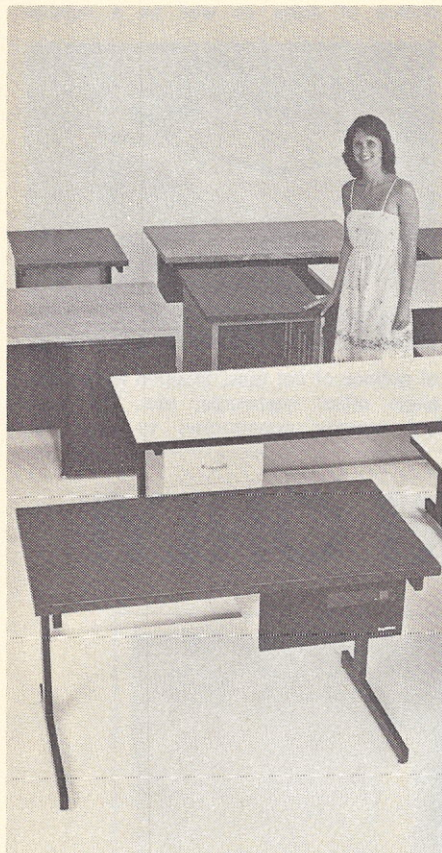
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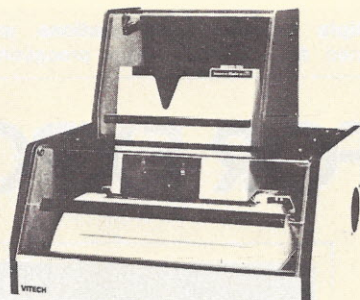
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CIRCLE INQUIRY NO. 12

stress of hard usage. Pre-wired electrical raceway minimizes unsightly wires. The stations have the additional feature of being adjustable to the desired height for maximum operator comfort and efficiency. They are available in right and left hand models. Structural Concepts, 1727 Van Wagoner, Spring Lake, MI 49456.

CIRCLE INQUIRY NO. 272

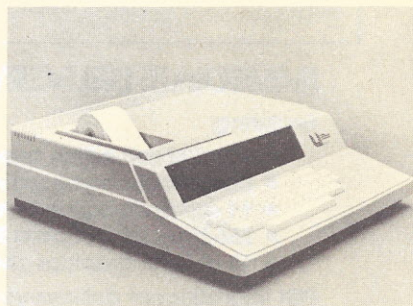
Sound enclosure minimizes noise pollution from word and data processing machines, Telex and computer terminals. The interior and exterior panels are covered with plastic laminate, eliminating the possibility of warping. All units have see-through acrylic



tops and allow easy access. Sound enclosures can be custom made for almost any type of printer. Price: model with sheet feeder, \$397; other models start at \$275. Vitec, 4555 W. 77th St., Suite 125, Edina, MN 55435, (612) 831-8757.

CIRCLE INQUIRY NO. 273

Computer enclosure, Ace-100, is designed to accommodate Rockwell International's Aim-65, add-on power supplies, circuit boards, 16 key numeric pad and other assemblies. The enclosure is built on a sheet metal base with rear connector panel and brackets for mounting the keyboard and printed circuit board assemblies. Add-on printed circuit boards are located below the



Aim-65 master module, using hinged stand-offs for easy board access. The assembly is housed in a vacuum formed ABS top cover with removable printer access panel for paper replacement. Basic enclosure price: \$169. Unique Data Systems, Inc., 15041 Moran St., Suite 201, Westminster, CA 92683, (714) 897-3371.

CIRCLE INQUIRY NO. 275

Printout storage and retrieval system, Mini-Rack, includes a suspension rack with casters, and four genuine pressboard hanger binders. The rack holds up to 3,600 unburst 14-7/8-in. by 11-in. printout sheets, ideal for offices with minicomputers. It has attractive woodgrain vinyl side panels for good looks

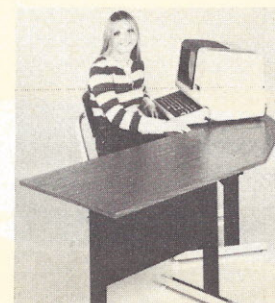
and black tubular steel for strength. It moves easily from desk to desk, department to department or filed under a desk. It's modular too. You can stack it to make a data bank. Or sit it on a desktop, counter or credenza. You



can remove the hanger binders from the top. Or with optional T-bar suspension system, you can remove binders from the sides. The binders come in four colors for color coding. Wilson Jones Co., 6150 Touhy Ave., Chicago, IL 60648.

CIRCLE INQUIRY NO. 276

Space Station, a line of modular, all-purpose workstations for data and word processing office equipment, can be used singly or joined in various modular configurations. The system enables stations to be securely joined to provide extra stability and strength. Tested to hold 400 pounds. Chrome, scratch-resistant



feet and black uprights and modesty panels with tops available in woodgrains of walnut and oak, and in putty. Depths are 24 and 30 inches, and lengths range from 30 to 42 inches. Prices start at \$120. James Systems Division, James Metal Products Co., 2929 N. Oakley Ave., Chicago, IL 60618.

CIRCLE INQUIRY NO. 278

Apple computer desk features an 11 by 42-in. CRT platform with a suspended shelf for floppy disk mounting. The basic desk size is 42 by 28 by 26-in. high. Fabricated with tubular steel legs, sheet metal modesty panel and formica laminate top, these desks



are available in black or champagne with teak or walnut tops. Optional casters are available.

APRIL 1981

Dealer and OEM discounts are available. Computer Furniture and Accessories, 1441 W. 132nd St., Gardena, CA 90245.

CIRCLE INQUIRY NO. 279

I/O

I/O modules enable the IBM model 50, 60 and 75 electronic typewriters to perform as



computer RS232 devices. The modules offer 2 alternatives for using these high-quality typewriters in automation applications without interfering with normal typewriter usage. The modules can be installed or removed in minutes. No modifications are made to the typewriter. The model 5061 is a print-only version while the model 5060 performs full terminal functions. Both units offer Ascii coding with full buffering. The 5061 sells for \$497 and the 5060 sells for \$860. California Micro Computer, 9323 Warbler Ave., Fountain Valley, CA 92708, (714) 968-0890.

CIRCLE INQUIRY NO. 280

Plug-in processor board for the Apple II supercharges the stock microcomputer with the Motorola 6809E processor, a high speed device optimized for real time data acquisition, stack type languages such as Forth and Pascal, and concurrent programming tasks. New applications include manufacturing and laboratory process control monitoring. The higher 6809 speed coupled with concurrent programming and interrupts lets users rely on the system for immediate response to process variables. Additionally, programs may perform computations on measurement data for real time control and data logging applications. It brings the world of 6800 software to the Apple II community. Users may run existing 6502 programs or use software developed for the Motorola 6800 processor: the assembler for the 6809 will readily compile 6800 instructions into 6809 object code. In operation, the 6809 and the 6502 run concurrently, allowing both processors to perform internal operations independently. The 6809 acts as the bus master during the 6502's bus access: typically, the 6809 commands 80% of available bus time for memory accesses and data transfers. The 6502 may, however, halt the 6809 on the bus for time critical I/O operations. Price: \$278. Stellation Two, P.O. Box 2342, Santa Barbara, CA 93120.

CIRCLE INQUIRY NO. 281

Intelligent Interface, Teletek's I², is an IEEE S-100 board capable of interfacing parallel devices, including intelligent hard disks, tape backup controllers, parallel printers to the S-100 bus. Capable of running at 4 MHz without wait states (6 MHz optionally), it has

on-board intelligence in the form of a Z80A CPU plus RAM, and a 2716 Eprom containing a monitor with appropriate initialization and driver routines tailored to the specific controllers the user wishes to interface. The board has two 8-bit bidirectional parallel ports with handshaking, two latched 8-bit output ports and two terminated 6-bit input ports. It will perform all I/O transfer operations independent of system time thus freeing the system for parallel processing while printing out hard copy information. Teletek, 9767F Business Park Dr., Sacramento, CA 95827.

CIRCLE INQUIRY NO. 282

Portable calibrator, Ronan X85, is actually two instruments in one since an operator can instantly switch between the generated



input signal and the output of the device being calibrated. The unit weighs less than four pounds and generates input signals that emulate those put out by current, voltage and resistance type transducers in order to calibrate process monitors, alarm trips,

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CIRCLE INQUIRY NO. 82

alarm transmitters and complete process loops, for the adjusting of valves and inputs to computers. Input and output variables can be measured with a resolution of 0.01% of range on the 4½ digit display. High input/output isolation is maintained through the use of isolated floating power supplies. Input terminals are protected against over-voltages of up to 200 volts DC or peak AC. The calibrator provides a set of 2-wire terminals for simulating a 2-wire transmitter in a voltage powered current loop. It stands 8.375 inches high, 4.375 inches wide and 3.5 inches deep, and weighs 3 lbs., 15 oz. Price: \$995. Ronan Engineering Co., P.O. Box 1275, Woodland Hills, CA 91367, (213) 883-5211, Telex 698-490.

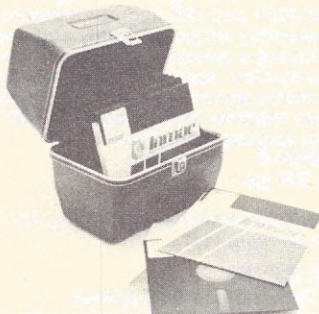
CIRCLE INQUIRY NO. 285

Converter board, model SB-64 D/A, is compatible with S-100 bus microcomputers and has 64 output channels. This extreme density is accomplished by multiplexing a single 8-bit converter. The multiplexing is invisible as the 64 channels perform like discreet D/A converters each with digital input latches, and a output Amp. The 64 outputs each drive a 1K ohm load, and have ±.4% absolute accuracy from 0V to 10.625V. Address decoding allows memory-mapped I/O to any 256 byte sector in the 65K. IEEE specifications for S-100 bus interface devices are fully met. Options are: 10 digital outputs, fast 12-bit DAC with 3 microsecond settling, ±15V tracking regulator with 600ma output, and 24-bit address decoding. Price: \$514. Digital Multi-Media Control, 2338 Patterson #12, Eugene, OR 97405, (503) 342-3181.

CIRCLE INQUIRY NO. 286

MISCELLANEOUS

Floppy case safely protects up to 50 floppy disks during travel. The case is small enough to fit under an airplane seat, yet still able to carry up to 50 floppies. A special polyethylene inner lining is used to ensure a soft dust-free environment. Polyethylene provides a smooth surface of low porosity which



protects disks by preventing harmful dust buildup. Seven sturdy dividers (also made of polyethylene) guard against disk bending by holding floppies firmly in place. Pared down for a sleek look, the case weighs only 2½ lbs. It's compact 10-in. by 10-in. by 7½-in. outside dimensions make it ideal for car or plane travel. Made of high-impact plastic, the case's rugged outer shell—with ribbed top—adds strength and rigidity. Together with the inner-lining and dividers, it guards against permanent data damage caused by sudden impacts. The outer shell's heavy grain resists mars and scuffs permitting the case to maintain its highly profes-

sional appearance. Price: \$65. Inmac, 2465 Augustine Dr., P.O. Box 4780, Santa Clara, CA 95051, (408) 727-1970.

CIRCLE INQUIRY NO. 287

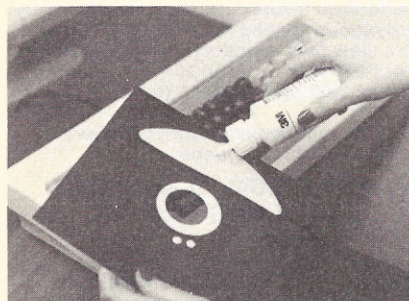
Talking clock automatically provides verbal time announcements on demand, or continuously. It is adaptable to a variety of applications where time verification is desired. It will log the time on magnetic tape immediately after a message is recorded or whenever a time announcement is called for. The vocabulary is produced electronically by a solid-state, microprocessor-controlled



speech synthesizer. The distinctive male voice is clear and unambiguous. "It's eleven o'clock." "It's three fifteen p.m." A built-in back-up battery prevents time loss during power failure. The unit operates on either 110 VAC or 14 VDC. Price: \$385. Omnicon Electronics, 1 Mechanics St., Putnam, CT 06260, (203) 928-0377.

CIRCLE INQUIRY NO. 288

Cleaning kit for diskette heads, to aid in achieving fewer system interruptions and losses of data, use a unique wet-and-dry method by which a proprietary cleaning solution is applied to the porous cleaning fabric in the diskette envelope. The cleaning diskette is then run in a normal manner for 30 seconds. Two-sided systems may be cleaned with the same technique. Each kit comprises two diskettes and a bottle of fluid, quantities recommended for a maximum of 30 cleanings (15 per diskette). Price: \$30



per kit. Two cleaning diskette sizes available: 8-in. size, and 5½-in. 3M, P.O. Box 33600, St. Paul, MN 55133.

CIRCLE INQUIRY NO. 289

Video training tapes for FMS-80, a data base management program, are available on VHS or Beta Max format. The first 1½ hours explain the fundamentals of FMS-80 and how to generate file definitions, screens, reports or user defined menus. The tape shows computer generated displays and reports so that user interaction with the emphasized points can be obtained. The second training tape (approx. 2 hours) discusses the advanced features of FMS-80's

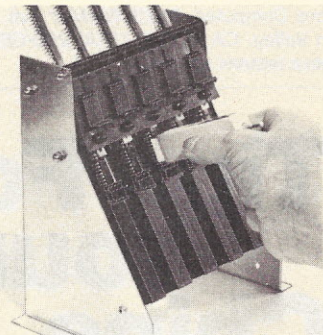
report generator and internal programming language called Extended File Maintenance. A detailed description of the report generator's math, page break capabilities and end-of-report analysis is presented. The language is described in great detail and includes multiple data file handling, math 'if'



statements, compares and temporary field generation. Systems Plus, 3975 E. Bayshore Blvd., Palo Alto, CA 94303, (415) 969-7047.

CIRCLE INQUIRY NO. 290

Dip IC dispensers, series MDD, for MOS and CMOS as well as standard devices offer flexibility and convenience to such a unique degree that they are patented. Each channel easily accepts any standard IC shipping tube, and can accommodate any standard IC from 2-64 pins on .300, .400 or .600 centers. Adjustable guides position each IC individually for easy extraction, and simple gravity feed



assures reliable deposit of next IC into extraction position after previous IC is removed. Ruggedly made of unique conductive carbon-filled thermoplastic with steel supports, the design assures effective static dissipation (a grounding lug is included) as well as long and reliable performance. Available in 1, 5, and 10-channel versions, the dispensers will greatly facilitate any IC handling or PCB assembly process. Price: \$21.85 for the MDD-1 (1 channel), \$83.43 for the MDD-5 and \$160.45 for the MDD-10. O.K. Machine and Tool Corp., 3455 Conner St., Bronx, NY 10475, (212) 994-6600.

CIRCLE INQUIRY NO. 292

PERIPHERALS

Advanced speech synthesizer can accommodate both standard and custom vocabularies up to a total of 256 utterances. The series III speech module consists of TSI's own speech synthesizer as well as vocabulary data memory, an on-board speech filter and an audio amplifier. Its TTL compatible I/O and +5V single supply simplify interfacing the module to a microcomputer. The memory

QT PRODUCTS

SBC+2/4 SINGLE BOARD COMPUTER

Features: 1K RAM (which can be located at any 1K boundary) plus one each Parallel and Serial I/O parts on board • Power on jump to on-board EPROM (2708 or 2716) • EPROM addressable on any 1K or 2K boundary • Full 64K use of RAM allowed in shadow mode • Programmable Baud rate selection, 110-9600 • 2 or 4MHz switch selectable • DMA capability allows MWRT signal generation on CPU board or elsewhere in system under DMA logic or front panel control • Two programmable timers available for use by programs run with the SBC+2/4 (timer output and controls available at parallel I/O connector; parallel input and output ports available for use on CPU board).

Bare Board \$ 60.00
Kit \$190.00
A&T \$295.00

Z+80 CPU

Features: Power on jump to on-board EPROM (2708, 2716 or 2732) • EPROM addressed on any 1K or 2K boundary; also shadow mode allows full 64K use of RAM • On-board USART for Synchronous or Asynchronous RS-232 Operation (Serial I/O port) • Programmable Baud rate selection, 110-9600 • Switch selectable 2 or 4 MHz • MWRITE signal generated if used without front panel • Front panel compatible.

Bare Board \$ 50.00
Kit \$150.00
A&T \$210.00

CLOCK/CALENDAR+ FOR APPLE II, S-100 OR TRS-80

Features: Date/Month/Year • Day of week • 24 hour time or 12 hour (a.m./p.m.) selectable • Leap year (perpetual calendar) • 4 interval interrupt timer; 1024Hz (approx. 1 millisecond), 1 sec., 1 min., 1 hr. • On-board battery backup • Simple time and date setting • Simple software interface • Time advance protection while reading.

S-100 or Apple	TRS-80
A&T \$150.00	A&T Only ... \$150.00
Kit \$100.00	
Bare Bd. \$ 60.00	

SMART PROTO BOARD+

Features: Wire-wrap or solder sockets • Accepts all std. sockets — .30" & .60" center • Allows grid distributed power • Three voltage regulators • Kluge area for discretes, ext. drives • Two bus bars for \pm voltages — int. & ext. • Accepts std. edge connector on .1" center • Kit includes 3 regulators/3 heat sinks/ filter capacitors/2 bus bars/Manual.

Bare Board \$ 35.00
Kit \$ 60.00

EXPANDABLE+ REV II DYNAMIC MEMORY BOARD

Features: Runs at 4MHz • 3242 refresh controller with delay line • Four layer PC board insures quiet operation • Supports 16K, 32K, 48K or 64K of memory • 24 IEEE-specified address lines • Optional M1 wait state allows error free operation with faster processors • Optional Phantom disable • Uses Z-80 or on-board refresh signal • Bank on/off signal selected by industry standard I/O port 40 (Hex) • Convenient DIP switch selection of data bus bits determines bank in use • 3 watts low power consumption • Convenient LED indication of bank in use.

Definitely works with
Cromemco and North Star.

Bare Board \$ 75.00	
KIT	A&T
No RAM \$230.00	16K \$350.00
16K \$280.00	32K \$450.00
32K \$360.00	48K \$575.00
48K \$480.00	64K \$675.00
64K \$525.00	

RAM+16

Features: S-100, 16K x 8 bit static RAM • 2 or 4 MHz • Uses 2114 1K x 4 static RAM chip • 4K step addressable • 1K increment memory protection, from bottom board address up or top down • Deactivates up to six 1K board segments to create "holes" for other devices • DIP switch selectable wait states • Phantom line DIP switch • Eight bank select lines expandable to 1/2 million byte system • Data, address and control lines all input buffered • Ignores I/O commands at board address.

Bare Board \$ 35.00
4Mhz Kit \$180.00
4Mhz A&T \$210.00

WATCH FOR THE FOLLOWING NEW BDS:

- 4 Port Serial Bd (FEB)
- E-PROM Programmer (MAR)
- Floppy Disk Controller (APR)
- Hard Disk Controller (MAY)
- Color Video Bd (JUN)

I/O+ INDUSTRIAL GRADE I/O BD

Has two serial Sync/Async ports (RS-232, current loop or TTL) with individual Xtal controlled programmable baudrate generators • Four 8-bit Parallel ports; one latched input port and other three can be programmed in combinations of input, output or bidirectional • Also, has three 16-bit Programmable Timers and an 8-level Programmable Interrupt Controller w/Auto restart (8080 / Z80) • Other features include; on-board clock divisor for timers, completely socketed, wire wrap posts for easy port configuration plus more.

Bare Board \$ 70.00
Kit \$200.00
A&T \$375.00

SILENCE+ MOTHERBOARDS

These motherboards are among the quietest on the market. A unique grounding matrix — with each line completely surrounded by ground shielding — eliminates need for termination and gives high crosstalk rejection • They're customer-proven, without crosstalk sometimes operating at 14MHz • A LED power indicator helps eliminate zapped circuits • IEEE S-100 std. compatible, available with 6, 8, 12, 18 or 22 slots • (The 22 slot board fits Imsai chassis and has slot for front panel.)

6 Slot	
Bare Board	\$ 25.00
Kit	\$ 40.00
A&T	\$ 50.00
8 Slot	
Bare Board	\$ 27.00
Kit	\$ 55.00
A&T	\$ 70.00
12 Slot	
Bare Board	\$ 30.00
Kit	\$ 70.00
A&T	\$ 90.00
18 Slot	
Bare Board	\$ 50.00
Kit	\$100.00
A&T	\$140.00

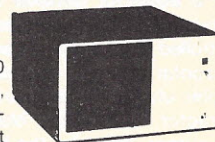
QT MAINFRAMES

5 1/4" Disk Mainframe with 18A Pwr Sup
MF+MD12 (12 slot M/B) \$500.00
MF+MD6 (6 slot M/B) \$450.00
MF+MD w/o M/B \$400.00

Q.T. Mainframe
MF+12 (12 slot M/B) \$450.00
MF+18 (18 slot M/B) \$500.00
MF+22 (22 slot M/B) \$600.00

MAINFRAME+ DISK DRIVE

Includes cabinet, 30 amp power supply, IEEE S-100 compatible 6, 8 or 12 slot motherboard and dual 8" disk drive with disk drive power supply.



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MF+DD8 \$650.00
MF+DD12 \$675.00

DDC-8 SINGLE 8" DISK CABINET

Accepts one 8" disk drive (Shugart, Remex, PerSci, Siemens, etc.) • Fan cooled, with data cable and AC line filter to eliminate EMI • Operates from 100-125VAC/200-250VAC at 50-60Hz • Disk drive NOT included.

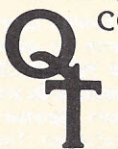
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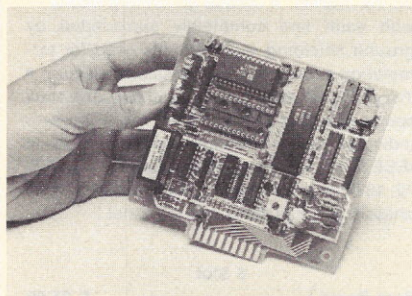
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(213) 970-0952

can be any combination of one or two 16K, 32K or 64K ROMs or Proms providing up to 128K bits. For example, series III can accommodate one 32K ROM for a TSI standard vocabulary plus one 16K bit Prom for a special-use custom vocabulary. Vocabularies



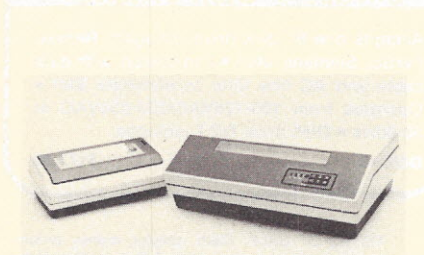
can be provided in English and most other languages. With the series III, about 100 seconds of speech can be stored in ROM memory so individual words and phrases can be retrieved on command. When provided with an 8-bit parallel binary address code and a start signal, the Custom ROM Controller (CRC) fetches appropriate data from the ROM and converts the digital information to an analog audio signal via an on-chip D/A converter. The analog signal is then filtered and amplified on the module resulting in a clear, highly intelligible male voice. Tele-sensory Systems, 3408 Hillview Ave., Palo Alto, CA 94304, (415) 493-2626.

CIRCLE INQUIRY NO. 295

80 character video board, the VB3, provides a flexible video display system for S-100 computers. The display may be programmed for up to forty-eight 80 character lines featuring upper and lower case letters with true descenders. Features include a second RAM block in addition to the video RAM which contains attribute bytes allowing characters to appear as a standard alphanumeric upper/lower case font or user-programmed font. Software for the board includes a CP/M-compatible driver routine and a powerful terminal simulator routine. Software controlled options include software controlled timing, top and bottom margins and horizontal position, inverted video, (2 by 4) graphic character, one-level of gray, blinking character, underline, blank-out character and cursor. Price for the board: \$645. SSM Microcomputer Products, Inc., 2190 Paragon Dr., San Jose, CA 95131, (408) 946-7400.

CIRCLE INQUIRY NO. 297

Two matrix printers for small systems applications, the P80 and P250, will be marketed worldwide to OEMs. P80 is a low-

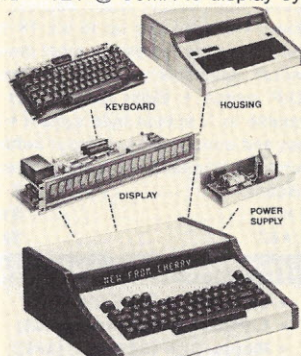


cost, 80-character-per-second matrix printer, designed to give reliable, high-performance operation. Features include true character

descenders; underlining; bidirectional logic seeking; processing of single-sheet, or continuous and roll forms; and self-testing routines. Priced at \$900 per printer in quantities of 100. The P250 represents an attractive and aggressively priced, low-cost alternative to line printers. At 250 characters-per-second, this compact printer is fast, portable and designed for many small systems applications, including distributed data processing and multi-terminal systems. The matrix print head uses a 7 by 9 character pattern with an option for 9 by 9 characters, and has true character descenders and underlining capabilities. Price: \$2,400 per unit in quantities of 100. Pertec, 12910 Culver Blvd., Los Angeles, CA 90066, (213) 822-9222.

CIRCLE INQUIRY NO. 304

Interactive alphanumeric display system consisting of four basic modular components is designed so that each one may be used alone or combined as a small size single line display terminal. Modules include: alphanumeric display with choice of 16 or 20 characters. This is a self-contained 14-segment, single line display. Complete microprocessor controlled circuitry includes drivers, character generator, refresh memory and provides all standard functions. The solid state capacitive keyboard has 66 Ascii encoded keys, plus functions for other keys with quick-change clear plastic relegendable tops. The power supply delivers +12V @ 1 amp and -12V @ 50mA to display system.

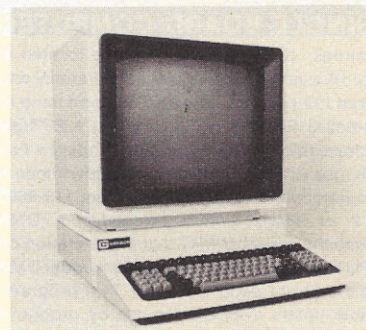


Operates from normal 120VAC, 60 Hz, .25 amp line voltage and comes equipped with proper plug for immediate interconnection. The housing comes in beige aluminum with solid hardwood sides. Space is also available inside the housing for installation of additional hardware. Cherry Electrical Products Corp., 3600 Sunset Ave., Waukegan, IL 60085, (312) 689-7702.

CIRCLE INQUIRY NO. 306

Raster graphics system, G-1000, is designed for applications such as CAD/CAM, plot previewing, electrical engineering, scientific data analysis, mapping and circuit board design which require precise detail and data manipulation capability plus economy. The Genisco G-1000 is the first low cost raster graphic display system to be based on the Z8001 segmented 16-bit microprocessor. This powerful processing capability permits the G-1000 to function as a dual purpose system: it is a direct raster scan replacement for the Tektronix 4014-1 terminal (including Plot-10 software compatibility); it is user programmable, offering up to 16K words of Eprom as well as 16K RAM. Resolution is 1024 by 792 by 1 bit. High performance 60Hz refresh assures flicker free viewing. The detachable keyboard includes typewriter-style alpha-

numeric keys, special function keys, a 12-key numeric pad and cursor controls for interactive capability. The entire system including a 19 inch display, keyboard, elec-



tronics chassis and power supply is packaged in a stand-alone configuration that can be used on a desk top or pedestal mounted. It employs an asynchronous serial interface that is RS232 compatible with data rates to 19.2K baud. Price: \$9,995. Gensico Computers, 3545 Cadillac Ave., Costa Mesa, CA 92626, (714) 556-4916.

CIRCLE INQUIRY NO. 307

Modular interactive terminal gives the user full-color, high-resolution raster scan graphics output from his host computer. The RM-6212 Colorgraphic terminal offers eight times the color selection, 25 times the vector-writing speed and more than twice the resolution of the RM-6200A. The unit can interface via serial asynchronous communications with any host computer using a standard RS232C interface. Suitable for business graphics, management information systems, CAD/CAM and educational applications, the unit offers resolution of 640 by 480 picture elements (pixels), with an option



for 640 by 512 pixels. Four refresh memory planes controlled by a user-programmable video look-up table permit the display of up to 16 colors selected from a palette of 64: eight colors plus either an alphanumeric overlay or a blink function. The look-up table also allows film loop animation and raster smoothing operations to be performed in software via user programming. Among graphics features are variable character sizes, local subroutines, and solid color fill capability even for complex shapes. Price: \$16,000. Ramtek Corp., 2211 Lawson Lane, Santa Clara, CA 95050, (408) 988-2211.

CIRCLE INQUIRY NO. 309

National keyboards, with the familiar character sets and key replacements for each language, are available on the HP 2635B printing terminal. The optional keyboards are German, French, United Kingdom, Spanish, Swedish/Finnish, and Norwegian/Danish. The national keyboard options also provide both

**Apple II or Apple II Plus
w/48K RAM**



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Disk II w/cont. & 3.3 DOS	\$539.00
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A 16K RAM personal computing system
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Software:

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• Z-64 4Mhz Z80 CPU with 64K	\$1099
• DS-F8 Double density cont.	429
• MD Cont. for shugart SA4004-8	769
• Multi/User I/O Board	249

California Computer Systems:

• 2065A 64K Dyn. RAM Bd.	550
• 2116C 16K Stat. RAM Bd.	345
• 2200A 12 Slt. S-100 Mnfrm.	379
• 2422A Floppy Disk Controller	350
• 2501A 12 Slt. S-100 Mthr Bd.	110

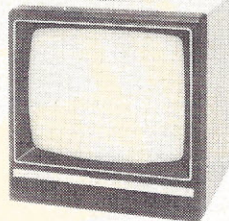
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800 line resolution monitor with Green
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The best buy in a printer you'll find anywhere.
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Texas Instruments

TI-58C	109.00	TI-59	209.00
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P10-D	80.00	P7-D	80.00
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6200	98.00	5813	35.00
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**PERIPHERALS:
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5510 R/O, RS232 (w) Tractor, thimble & ribbon. 55 CPS	\$2750.00
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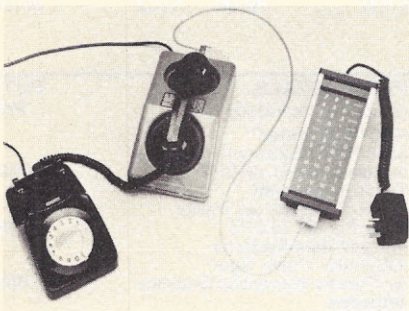
7-bit and 8-bit data communication codes. The HP 2635B thus can be used on systems that support standard 7-bit national language



character codes or 8-bit Roman Extension code. Roman Extension is a set of characters including those unique to the six national languages. The standard HP 2635B now contains Roman Extension and other special character sets such as segmented line draw and math symbols. Price: \$100 each. Inquiries Manager, Hewlett-Packard, 1507 Page Mill Rd., Palo Alto, CA 94304.

CIRCLE INQUIRY NO. 310

Hand-held terminal can be used to record, store and verify information before transmitting it by telephone to a computer for processing. The Microfin system allows new application programs to be loaded into terminals by phone line, using a secure com-

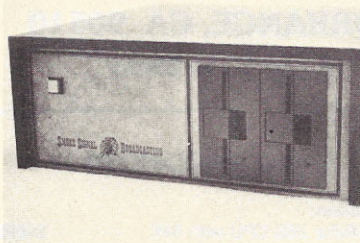


munications protocol. This ability eliminates the logistical problems involved in returning widely dispersed terminals to the manufacturer each time an application program is altered. The units can be transferred between applications or change their function within applications; only a short telephone call is necessary to load a different program. The standard, full alphanumeric keyboard combined with advanced software is suitable for most applications (previously a specific keyboard layout was needed for each application). The terminals also adapt easily to changing requirements. Microfin Systems Ltd., Winslade House, Egham Hill, Egham, Surrey TW20 OAZ England, telephone Egham (0784) 37674, telex 934534.

CIRCLE INQUIRY NO. 315

Flexible disk drive in double-track, double-bit, and double-sided design provides a total of 1 1/2 Mbytes of formatted storage capacity in its standard dual-drive configuration. Chief-tain model 9524 also incorporates 32K RAM, two serial ports, monitor in ROM and SSB's DOS69. The computer's 6809 microprocessor allows users to run programs in Basic at over 2 1/2 times the speed of 6800-based systems. Recording density of the drive is

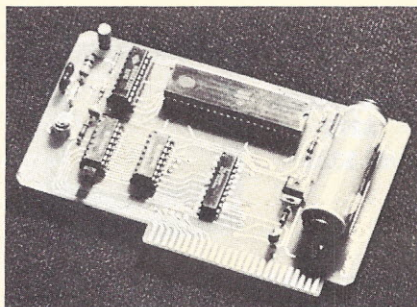
5,877 BPI with 80 tracks per side. Track-to-track time is 3 msecs and TPI is 96. Price:



\$4,075. Smoke Signal Broadcasting, 31336 Via Colinas, Westlake Village, CA 91362.

CIRCLE INQUIRY NO. 318

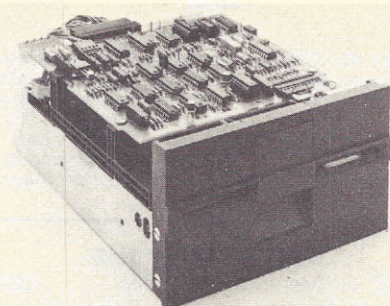
Real-time clock, Chrontronix ACV-1, for the Apple II computer is the first low-cost unit with 3 year battery backup requiring no recharging. Included are complete clock features (hr., min., sec., day, mo., yr.) plus programmable interrupts. Slot independent firmware is provided allowing very easy access from Basic (3 program lines). A set of software programs is also available on either cassette or disk to do dating of forms, stopwatch functions, time conversions, etc. This set is an especially useful bonus for computers used in the school room. Standard features include power-down ROM, high accuracy crystal and installed battery. Sockets are provided for either the standard



firmware or 256 bytes of user ROM. Price: \$109, complete with operating manual, firmware and schematics. Frisbee Electronics, P.O. Box 556, Ridgecrest, CA 93555.

CIRCLE INQUIRY NO. 319

Disk drives with track densities of 96 tracks per inch, the SA410 (single-sided) and SA460 (double-sided), minifloppys feature unfor-

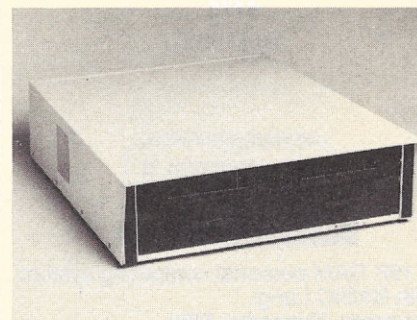


matted capacities of 500K bytes and 1M byte, respectively, using a double-density recording. The drives incorporate a helical cam v-groove lead screw for head positioning, rather than a band or disk positioner, for

improved access time. The single-point ball follower in the screw eliminates hysteresis (backlash) and minimizes friction. The drives also use a fast-starting DC spindle motor instead of the head-loading solenoid used in other drives. The motor allows the drive to be shut down when not in use to avoid the problems of head and media wear and damage caused by solenoid-controlled head loading. Prices: \$325 (SA410), and \$400 (SA460), in quantities of 100. Shugart Assoc., 475 Oakmead Parkway, Sunnyvale, CA 94086, (408) 733-0100.

CIRCLE INQUIRY NO. 321

Flexible disk system provides up to 3.2 Mbytes of data in a space only 5 1/4 inches high. The 48 subsystem incorporates RFS 4810 master drive, with an on-board microprocessor based controller/formatter, a minimum-electronics RFS 4820 slave drive (which is controlled by the electronics of the RFS 4810 drive), a DC power supply and enclosure. All are housed in a rack mountable chassis measuring 19 inches wide, 5.22 inches high and 21.32 inches in depth. The



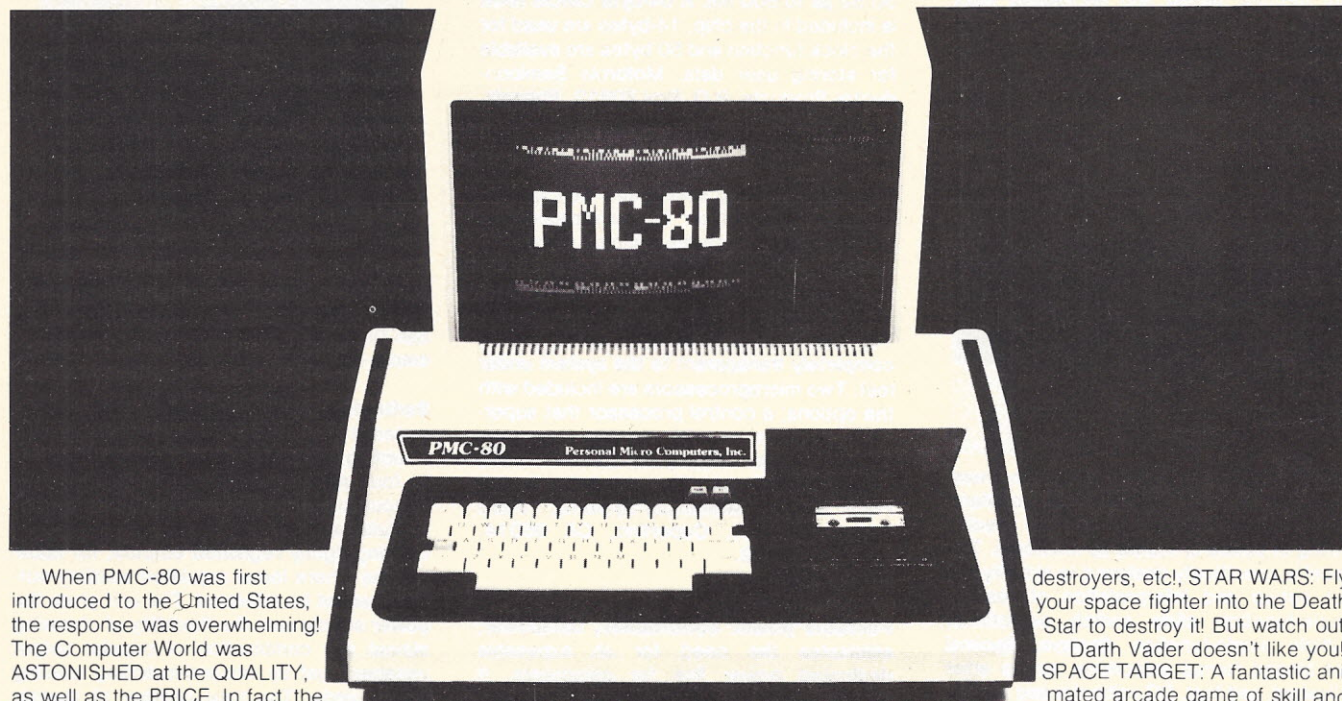
subsystem features the dual-head drive and in double density encoding, provides 1.6 Mbytes of unformatted data per drive. Under control of the intelligent controller/formatter, the system will configure data in a choice of formats including IBM compatible 26, 15 or 8 sector-per-track schemes, expanded capacity formats, and a unique double density 46 sector-per-track format for users with a substantial investment in traditional single density configurations. Among the performance features are: multiple sector data transfer—from one sector to an entire diskette side can be transferred with a single command; fully automatic disk initialization; automatic diskette-to-diskette copy; and automatic density switching allowing the drive to read single or double density diskettes interchangeably without adjustment of manual switches. Access speed of the system drives in less than 3 ms track-to-track with heads positioned by a split band/stepper motor system. Optical write protect and door locks are standard features. A 1 Kbyte buffer maintained on the drive controller allows for constant transfer rates under varying central processing unit conditions. Price: \$1,997. Ex-Cell-O Corp., Remex Div., 1733 E. Alton St., P.O. Box C19533, Irvine, CA 92713, (714) 957-0039.

CIRCLE INQUIRY NO. 322

TOOLS & TEST

Data link analyzer is capable of simultaneously displaying 12 line measurements and test parameters. The Epilert model 301 detects and displays (1) bit errors, (2) block errors, (3) block count, (4) RTS/CTS delay,

THE AFFORDABLE HOME COMPUTER



When PMC-80 was first introduced to the United States, the response was overwhelming! The Computer World was **ASTONISHED** at the **QUALITY**, as well as the **PRICE**. In fact, the PMC-80 has almost all the features of America's best selling computer, the TRS-80, but with a price tag of \$200.00 less! (SIMUTEK'S price is \$275.00 less!)

Microsoft's Level II Basic and 16K Memory.

Another reason for all the commotion is that the PMC-80 uses the same, easy to learn, **LEVEL II BASIC** language that the TRS-80 uses! What does this mean? It means that the PMC-80 can run all the 1000's of programs that have been written for the TRS-80 Level II, 16K computer! Some of the programs available include: Flight simulation, World Champion Chess program, Scores of educational and business programs. Word processing programs and hundreds of other games and simulations.

The PMC-80 is expandable!

Your PMC-80 is ready to grow with your needs. Using a special cable, available from Simutek for \$35.00, it may be connected to Radio Shack's Expansion interface, to give you up to 48,000 characters of memory, up to 4 disk drives, addition of a telephone communication system, Voice Synthesizer, various printers, a real time clock, as well as plotters and other neat interfaces! As your skills with the PMC-80 improve, you're sure to want some of the **ADD-ON's** described above. (And these are just a few!)

Save Money! Use your own television!

The PMC-80 has a built in **RF MODULATOR** so you can use your black and white or color TV for a **VIDEO MONITOR**! A simple hook-up to your television's antenna connector, makes channel 3 your computer's video channel.

Special Introductory Offer: 25 Free Programs

SIMUTEK, a leading innovator in Home Computer Software, is making a **SPECTACULAR INTRODUCTORY OFFER**

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Comparison Chart

Features	PMC-80	TRS-80
Microsoft's Fantastic Level II Basic	Yes	Yes
Full 128 x 48 Graphics	Yes	Yes
16,000 characters memory	Yes	Yes
Tape recorder for storing or retrieving programs	Yes	Yes
Use your own TV (Save \$5)	Yes	No
Expandable to 48,000 characters of in computer memory	Yes	Yes
Use TRS-80 expansion interface	Yes	Yes
Expandable to 4 floppy disk drives (over 100,000 characters of storage on each one!)	Yes	Yes
Telephone Communications available: connect to large computers/electronic mail etc.	Yes	Yes
1000's of ready made programs available for "educational" and "scientific" applications?	Yes	Yes
Printers available	Yes	Yes
High Speed Z80 CPU	Yes	Yes
Interface available for controlling lights and appliances in home	Yes	Yes
Retail Price	\$645.00	\$849.00

to people that **ORDER** the PMC-80 NOW. With each purchase, we will give 25 **FREE HOME COMPUTER PROGRAMS**! Some of these include: Home Amortization tables program, Loan payment programs, Depreciation rate program, Interest table program, Annuity and Investment calculation programs as well as these great animated games: **GRAPHIC-TREK 2000: Command the Enterprise!**, **INVASION WORG..** Stop the invading marauders from space before they take over earth! You command Earth's forces of androids, space fighters, laser guns etc., against the enemy's robots, saucers, proton

destroyers, etc!, **STAR WARS: Fly your space fighter into the Death Star to destroy it!** But watch out, **Darth Vader** doesn't like you!, **SPACE TARGET: A fantastic animated arcade game of skill and daring!**, **SAUCERS: Can you win the coveted Medal of Honor?**

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The PMC-80 microcomputer with 16,000 characters of "In Computer Memory", Microsoft's Level II Basic (in 12K ROM), a cassette player for storing or retrieving programs or data (cassette player is built into the computer!), an RF Modulator for connecting the PMC-80 to your television set, 25 **FREE** programs so you start using your computer immediately, complete instruction manual, learning manual and owners manual so you can begin writing your own programs right away!

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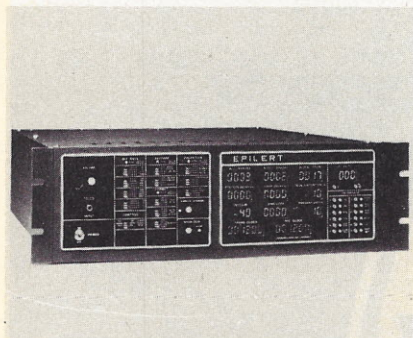
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TRS-80 is a registered trademark of Radio Shack, a Tandy Corp.

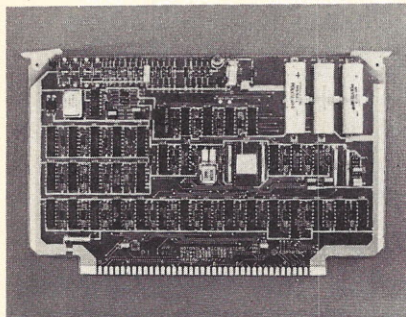
(5) loop delay, (6) percent peak distortion, (7) Telco db, (8) sync loss, (9) percent present distortion, (10) transmit clock rate, (11) receive clock rate and (12) DC voltage. The instrument is applicable on voice grade data circuits, digital and microwave links, modems, multiplexers, and other data communications equipment. Using the large number of switch-selectable data patterns, the unit can thoroughly exercise a network



and rapidly identify potential problem areas. Either the 'activate controlled' or 'constant' carrier mode may be utilized for precise testing of polled or multidrop networks. The model is specifically designed to simplify the test set-up and interpretation of results. Single-function slide switch selections, multiple single-function displays, decimal (not binary) format selections, set-up error indicators, self test, DC voltmeter and audible and db measurement of Telco input, contribute to the unit's versatility. The model is 5 1/4-in. rack-mountable; when equipped with front cover, handle, and feet it becomes a portable instrument for on-site work. Epicom, 592 N. Douglas Ave., Altamonte Springs, FL 32701, (305) 869-5000.

CIRCLE INQUIRY NO. 329

Power monitor and time-of-day clock micro-modules improve system reliability. Three versions of the same PCB are available—the M68MM10A (power monitor function), the M68MM10B (power monitor plus battery backed-up real-time clock/calendar plus RAM function), and M68MM10C (time-of-day



clock and RAM function only). The A and B versions of this new micro-module provide the required sequence of power-up and power-down signals to a system that incorporates non-volatile memory, e.g. battery backed-up RAM. This new board monitors the AC line voltage, and detects either an abrupt power loss or a low voltage brown-out condition. The abrupt power loss is detected after 2.0 ms of no line voltage. The brown-out condition is detected when the input line voltage drops below a user-selectable value. The optional versions with CMOS time-of-day clock and RAM with battery backup provide a number of additional features that are required in many applications. The software

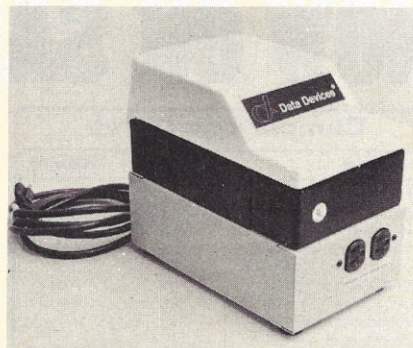
settable/readable calendar and time-of-day clock allow time-tagging data and events. Real-time tasks can be initiated by the hour-minute-second alarm conditions or by software selectable periodic interrupts from 30.52 μ s to 500 ms. A 64-byte CMOS RAM is included in the chip, 14-bytes are used for the clock function and 50 bytes are available for storing user data. Motorola Semiconductor Products, P.O. Box 70912, Phoenix, AZ 85036.

CIRCLE INQUIRY NO. 331

Functional board tester and fault isolator Microsystem Analyzer for microprocessor-based products features in-circuit emulation, signature analysis and count, interval and frequency measurements to perform real-time functional testing and fault isolation. The 6801 and 6803 emulator option is also completely transparent to the system under test. Two microprocessors are included with the options; a control processor that supervises system resources and executes system monitor commands; and a 6803NR microprocessor on the emulator board. Price: \$2,675. Millennium Systems, 19050 Pruneridge Ave., Cupertino, CA 95014, (408) 996-9109.

CIRCLE INQUIRY NO. 332

Portable power conditioner, Datapower, eliminates the need for an expensive dedicated power line for computers. It greatly reduces equipment failures related to power fluctuations. Input voltages as low



as 25% below normal (87 volts) are regulated immediately to within $\pm 7\%$ of nominal. The unit is UL listed and unconditionally guaranteed. It solves clean power line problems for computers, minicomputers, security systems, peripherals, word processing equipment, and microcomputers. It is portable and easy-to-use and requires no installation cost. Prices range from \$995 for the smallest 60 HZ model to \$2,195 for the largest 50 HZ model. There are seven models to choose from. Data Devices Int'l., 20235 Bahama St., Chatsworth, CA 91311, (213) 998-2900.

CIRCLE INQUIRY NO. 334

Power conditioner, 500 VA line 2, is designed especially for small business computers. Power line noise, voltage sags and surges, brownouts—all can now be prevented from affecting equipment operation. It combines a noise suppressing ultra-isolator and an AC line regulator into one convenient unit. This dual capability enables line 2 to eliminate power-related memory loss, program error, system malfunction and downtime. It plugs into the existing 120v outlet, eliminating the need for an expensive dedicated power line. Designed specifically for business environments, line 2 models are attractive additions to existing equipment.

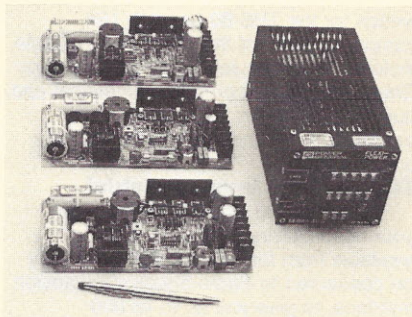
They feature excellent dynamic regulation, low output impedance, response time of one



cycle and energy saving 94% efficiency. Topaz Electronics Div., 3855 Ruffin Rd., San Diego, CA 92123, (714) 279-0831.

CIRCLE INQUIRY NO. 335

Switching power supply, Flexi-Power series 4120, is an innovative idea of constructing a multiple output switcher with up to four outputs totaling 120 watts of continuous output power. The series takes a modular approach to power supply design, offering tightly regulated outputs, for applications where loose regulated auxiliary outputs cannot be tolerated. The unit gives the power supply user the flexibility of choosing almost any combination of popular output voltages, just by mix-and-matching existing P.C. boards. The total number of models available out of this scheme is 72. With all the existing variety of output voltages and currents, the customer can have a customized standard off-the-shelf unit in the 120 watt range without paying premium price for a special custom unit. There are two distinct output channels in the unit, each channel's output terminating on a high quality non-breakable barrier strip on the front of the package for easy connections. Each channel provides up to two output voltages and also



an inhibit terminal is provided on each channel for sequential turn-on, if required. The unit measures 9.1 by 4.3 by 4.36 inches and it weighs approximately 4 lbs. Other features include custom made aluminum extrusion housing, black anodized, with stainless steel captive hardware on three sides for easy mounting. The unit is completely enclosed to suppress radiated EMI/RFI. Some typical output voltages and current combinations are +5VDC@12A/ +12VDC@3A/ -12VDC@2A, +5VDC@8A/ -5VDC@4A/ +12VDC@3A/ -12VDC@2A, +5VDC@8A/ +24VDC@0.5A/ ± 15 VDC@2A. Prices range from \$115 to \$235 in singles. Power General, 152 Will Dr., Canton, MA 02021.

CIRCLE INQUIRY NO. 337

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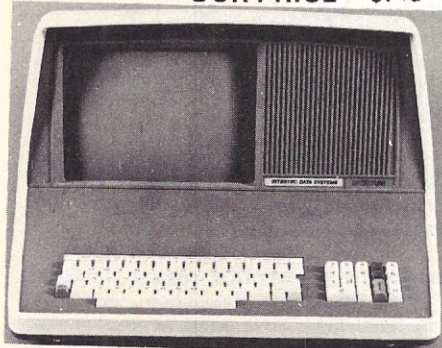
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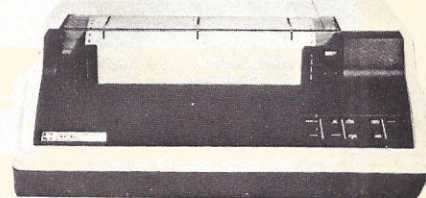
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CIRCLE INQUIRY NO. 102

TI-810

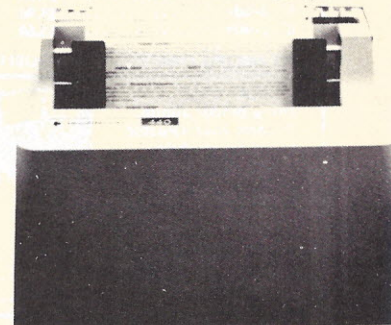


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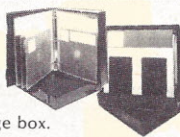
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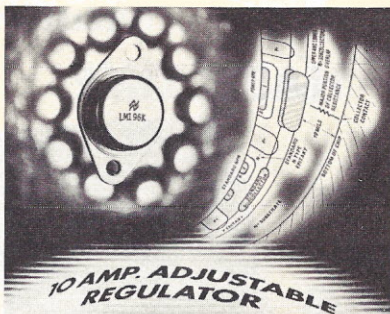
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CIRCLE INQUIRY NO. 83

Monolithic 3-terminal regulator offers the highest output power available. The LM196 is a 10 amp monolithic adjustable voltage regulator manufactured with the Moose process. This combines standard linear bipolar technology with high power discrete transistor techniques, resulting in a 2:1 reduction in die size, plus significant improvements in efficiency. Another major benefit of the process is the elimination of top side bonds to the collector of the power transistor, allowing much more efficient use of silicon and improves reliability by minimizing the number of bond wires. About 7 amps is the limit for an efficient power transistor bonding arrangement using standard technology. With Moose 30 amps can be regulated simply by increasing silicon area. The process does not compromise the



standard monolithic processing, however, so the unit has performance features equal to or better than existing lower power IC regulators. Specifically, the internal reference is trimmed on-chip to better than 1% accuracy, simultaneously reducing temperature drift to a typical value of 0.003%/°C. But the unit goes one step further by guaranteeing TC to a low 0.01%/°C. The regulator is specified for 200°C maximum junction temperature in the power transistor. This allows up to 45 watts power dissipation at a case temperature of 125°C. Up to 70W can be dissipated at lower temperatures. National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.

CIRCLE INQUIRY NO. 339

Memory diagnostic and disk repair package for the 6800 microprocessor is designed to run under the 6800 Flex operating system. Memory diagnostics software includes: zeroes and ones test, random pattern test, walking bit tests, dynamic RAM dropout test, and a convergence test. Disk repair contains utilities which operate on a Flex-formatted diskette. Included are 3 diagnostic utilities which report unreadable sectors and structural inconsistencies among the files on the diskette, 2 utilities for recovering data when the directory on the diskette is not readable, a utility to remove bad or intermittent sectors from the free space, a program to retrieve deleted files from the diskette free chain, a single-sector read/write/modify routine, and a copy utility which ignores CRC errors. The manual includes descriptions of the diagnostics, some background information types of errors, and troubleshooting guides. Price: \$75. Technical Systems Consultants, Box 2570, W. Lafayette, IN 47906, (317) 463-2502, telex 276143.

CIRCLE INQUIRY NO. 341

SOFTWARE

BUSINESS

General ledger program for the Commodore disk based systems with 32K bytes and 2022 printer or equivalent requires 4.0 ROM in either the 2001 or 8032 series and uses 2040, 4040 or 8050 dual disks. The package is designed for small business and features an easy-to-use menu driven screen oriented monitor and a user defined chart of accounts holding a maximum of 100 records per month up to disk capacity in each of the following categories: assets, liabilities, capital, revenue, material and expenses. The program accommodates the following seven lines of information per record: account #, item, ingoing/outgoing, amount, date, check/cash and remark. The program generates the following printed reports: general ledger by month, income statement with year to day, and balance statement. The package includes disk utilities. Price: \$250. Systems Design, P.O. Box 641, Orange, CA 92668, (714) 771-4038.

CIRCLE INQUIRY NO. 345

Graph plotting for line printer (3 programs) will provide a hardcopy of particular graph, either for inclusion in a report or for later comparison with other results. The programs contained in this package are complete and require no additional programming. The programs included are Cartesian Plots; Semi-Logarithmic Plots, and Polar Plots. No. 26000—TRS-80 (tape); No. 26023—Apple (tape); No. 26016—OSI (tape); No. 26009—Apple



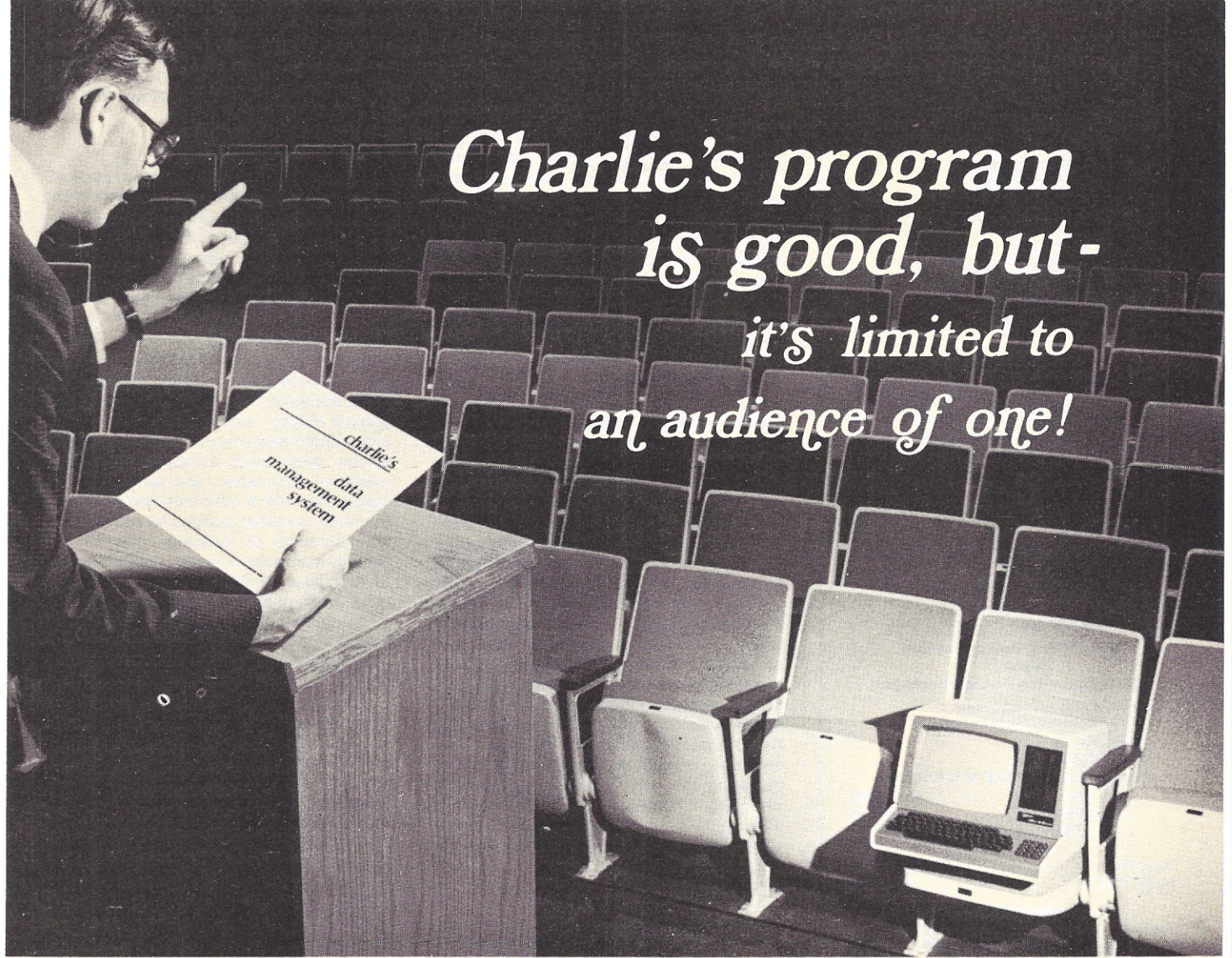
(disk); No. 26030—OSI (disk). Howard W. Sams & Co., 4300 W. 62nd St., P.O. Box 7092, Indianapolis, IN 46206.

CIRCLE INQUIRY NO. 348

Telephone information system provides on-site, on-demand telephone reporting. Zap-Call/System 10 is aimed at applications



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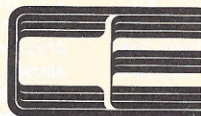
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CIRCLE INQUIRY NO. 86

analysis. It is compatible with all major computerized PABXs. Usage reports include both summary and detail on individual extensions, cost centers, divisions, client/account numbers and total organizations. It also includes local, day direct distance dial, and private line costing; complete file maintenance programs; and system test programs; and system test programs for local and remote diagnostics. In addition, Application Modules for network management and local and remote data communications are offered. Price: \$9,900 including complete system software, hardware, documentation, training and support. Telephone Management Systems, 180 Bear Hill Rd., Waltham, MA 02154, (617) 890-6565.

CIRCLE INQUIRY NO. 350

Mailing system enables users to save up to 45% on forms processing costs while speeding mail preparation. The Copy-Saver system is a self-contained mailer that allows the mailing envelope address and the monthly statement or other copy inside to be computer printed at the same time, without the need for an exterior copy. The entire envelope is computer printed, yet—almost like magic—only the mailing address shows! Pre-enclosed copies eliminate the need for folding, inserting and sealing. The new system is a boon for mailers who do not require a file copy because their records are kept in computer memory, or those who use the exterior copy only to prevent confidential data from appearing on the face of the envelope. Besides saving time and cost of deleafing the exterior copy, and possibly disposing of it, the system can typically save 12% to 15% on forms freight and storage costs. Uarco, W. County Line Rd., Barrington, IL 60010.

CIRCLE INQUIRY NO. 351

Business graphics and analysis system, Trend-Spotter, is a friendly user interface, tailored to the needs of today's executive, providing the user with the ability to spot emerging trends through quick manipulation and graphing of business data. Designed for use on the Apple II+, the system will both generate and read VisiCalc-compatible files. Price: \$275. Software Resources, Inc., 44 Brattle St., Cambridge, MA 02138, (617) 491-6396.

CIRCLE INQUIRY NO. 353

Time and billing system for the legal profession operates with most microcomputers under CP/M. ESQ-1 is a completely integrated information system that was specifically written with the first time computer user in mind. It is functionally separated into several distinct modules for transaction entry (time incurred and disbursements), posting, file maintenance and inquiry, billing, receipts, reports, end of day backup, end of period updating and client analysis. The system records billable and non-billable time, cash receipts and escrow receipts, and escrow transfers. Inquiries into all files can be made with numerous criteria such as by client/matter, responsible attorney, invoice number, etc. The system provides complete billing and payment ledgers and optionally allows the user to apply receipts to the oldest invoices first or to specific invoices. It requires a 48K CP/M system, CBasic-2, two disk drives with 220K bytes per drive, a CRT terminal with direct cursor addressing and a 132 column

printer. The complete system and documentation including a 45 minute cassette training tape is available for \$1,500. Lifeboat Assoc., 1651 Third Ave., New York, NY 10028, (212) 860-0300.

CIRCLE INQUIRY NO. 355

Business manager, an integrated accounting system, tracks sales, performs accounting functions and keeps inventory up-to-date with a minimum of effort. It provides historical data and reports for planning and analysis. It automatically handles data transfers, updates receivables with sales information, updating inventory when parts are required for an order, and automatically updating the general ledger for all activities that effect it. There are six accounting modules: sales order entry, accounts receivable, inventory control, general ledger, accounts payable and purchase order management. A customer inquiry module gives quick access to credit and collection information, and can be used in conjunction with a word processing package to create customer mailings for promotion of new products or pursuing collections. A security management system controls access to programs and files by assigning one of three levels of activity for each operator and for each program module. Memory expansion, addition of terminals and printers, and growth of disk storage capacity from 630 Kbytes to 96 Mbytes can all be handled without reprogramming. Dynabyte, 115 Independence Dr., Menlo Park, CA 94025, (415) 329-8021.

CIRCLE INQUIRY NO. 358

Inventory control system for the TRS-80 model II will handle up to 5000 items with full integration to both the invoicing and general ledger systems. Price: \$399, including manual. Taranto & Assoc., Inc., P.O. Box 6216, 121B Paul Dr., San Rafael, CA 94903, (415) 472-2670.

CIRCLE INQUIRY NO. 362

Job cost system operates independently or can be linked to the accounts payable and payroll systems for automatic job cost tracking. All supplier, subcontractor, and direct labor costs are segregated and can be automatically entered from other systems. The system also has the capability of apportioning actual overhead from specified general ledger accounts. Overhead can be spread to individual jobs, based on direct labor costs, total job costs or a user specified percentage. The built-in flexibility of the report writer allows the user to select complete trade reports by detail or summary. Specific jobs or portions of certain jobs may be selected for printing. Using original cost estimates, the system monitors actual expenditures and cost-to-complete projections to forecast profit or overrun. With this system, overruns can be detected early enough by management to take corrective action. Construction Data Control, 1330 Healey Bldg., 57 Forsyth St., Atlanta, GA 30303.

CIRCLE INQUIRY NO. 363

Package of Basic programs, the Depreciation system, written for the North Star disk system provides comprehensive depreciation preparation aids for accounting services and allows the user to create files of assets for each client. Each asset record contains a complete record of past and future depreciation amounts. Complete control of the asset records allows usage of non-standard depre-

ciation methods in addition to the standard methods of straight line, declining balance and sum of year-digits. The standard methods will be automatically calculated by the system and used in the asset records by user request. The system will work with either single or double density and can be user modified to support the user's precision. Price: \$75. Business Computer Systems, 900 Roanoke Dr., Springfield, IL 62702.

CIRCLE INQUIRY NO. 376

Wordcheck checks every single word for spelling or typographical errors on letters and documents. Program contains a spelling list of about 2000 commonly used words and suffixes. Words not on the list will show on the screen. If correct, words will pass by or be automatically added to the 1000-word auxiliary spelling list without having to retype. For doctors, lawyers, technical writers. Proofreads an average page in 2 minutes. Available for CBM and Pet 32K machines with disk drives. Price: \$200. Micro Computer Industries, 1520 E. Mulberry, Suite 110, Ft. Collins, CO 80524.

CIRCLE INQUIRY NO. 370

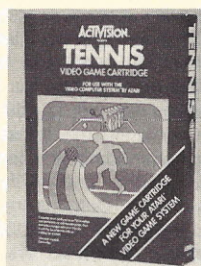
GAMES

Hellfire warrior is a sequel to the best-selling Temple of Apshai. It is a fantasy role-playing adventure for experienced adventurers, with more magic, more detail and more command options than ever before. It transports you to a world where you are the hero. You have to rescue the beautiful Warrior maid Brynhild, bring her back to the sun and air, and break the spell that binds

her. In this world of magic and monsters, to say that the challenges are great is the ultimate understatement. The game is available on cassette for the Pet (32K), and TRS-80 (level II, 16K), and on disk for the TRS-80 (32K), and the Apple (48K with ROM Apple-soft) for \$39.95. Automated Simulations, P.O. Box 4247, Mountain View, CA 94040.

CIRCLE INQUIRY NO. 385

Laser Blast and Tennis are two video game cartridges designed for the Atari and the Sears Tele-Game. Laser Blast places the player in command of a fleet of spacecraft under attack by forces on a hostile planet. To survive, the player must blast away



attackers with his ship's laser, while dodging radar-directed laser fire from below. As play progresses, the action increases in speed and difficulty, placing a premium on quick wits and reflexes. In Tennis, players can serve, hit from the baseline, rush the net and hit anything from drop shots to cross-court passing shots for winners. The graphics provide a unique perspective on the court, and

the movement of play is so realistic that the ball even has a shadow following it. Price: \$21.95 each. Activision, Inc., 759 E. Evelyn Ave., Sunnyvale, CA 94086, (408) 245-5421.

CIRCLE INQUIRY NO. 387

Fantasy game, Lords of Karma, is the first of a series that capitalizes on role playing. The computer becomes one's eyes and ears, but the player makes all the decisions. There are almost no rules to learn; one simply tells the computer what to do by typing simple English sentences on the keyboard, like "walk north." The game can be played on TRS-80 level II 48K, Apple II 32K, and Pet 32K. Price: \$20. Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214, (301) 254-5300.

CIRCLE INQUIRY NO. 388

One-on-one basketball game, Basketball, tests your skills against an all-star computer. Defend your basket; steal the ball and dazzle your opponent with footwork; shoot a layup in close to the basket or attempt the lower percentage jump shot from farther out. Designed for the model I level II TRS-80, the game features a five-key player control range allowing defensive play backwards, defensive coverage and offensive maneuvers from side-to-side, offensive drives forward down court, and shooting/scoring capability at any time beyond the center line. Single player option offers five levels of difficulty. Price: \$14.95 on cassette or \$20.95 on diskette. Acorn Software Products, Inc., 634 N. Carolina Ave., S.E. Washington, D.C. 20003, (202) 544-5259.

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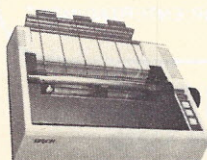


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CIRCLE INQUIRY NO. 391

Managing bowling league data on the Apple II provides accurate record keeping and report generation for bowling leagues. Designed for leagues of up to 40 teams with up to six bowlers per team, this system allows a league secretary to customize virtually all pertinent parameters. Weekly scores for each bowler are entered from score sheets, and the system prints a weekly recap report and the score sheets to be used for the following week, automatically generating team and lane pairings. Available on disk for \$79.95 with 32 pages of documentation. Rainbow Computing, Inc., 9719 Reseda Blvd., Northridge, CA 91324.

CIRCLE INQUIRY NO. 393

of words in a document, the typist presses the "spell" key. The system electronically scans the document. A cursor on the video



display shows exactly what is happening. The spelling of each word is quickly and automatically compared to the dictionary. The dictionary is able to: learn and retain user-added new words; add new words at any time, even while the typist edits the document; accommodate any length document stored on system and verify a one-page letter in seconds. Compucorp, 1901 S. Bundy Dr., Los Angeles, CA 90025, (213) 820-2503.

CIRCLE INQUIRY NO. 379

Learning packages, Compucourse, are comprised of microcomputer software and printed self-study materials which address business and general interest areas. Planning Cash Flow program provides techniques for the management of working capital (including not only cash, but also short-term securities, receivables, inventory, payables, and short- and intermediate-term debt), and covers sources and uses of short-term funds. It also teaches timing of cash flows, how to

turn inventory into cash, and how to manage money more efficiently. The software runs on the Apple II with Extended Basic, and on the Apple II Plus, requiring a disk drive and 32K of memory. The component programs, Micro-Applications, help the user to develop a cash requirement forecast for the coming year. The user then learns how to maximize his cash position by using his computer to: perform an analysis of working capital, reviewing key factors such as liquidity ratios; analyze the effects of changes in the credit policy on profits and receivables; evaluate changes in an predetermine inventory requirements, including quantity and frequency optimization; and develop a complete cash flow plan to assist in determining financing requirements and cash surplus. Price: \$99.95. Educational Programming Systems, 1328 Baur Blvd., St. Louis, MO 63132, (314) 991-0300.

CIRCLE INQUIRY NO. 380

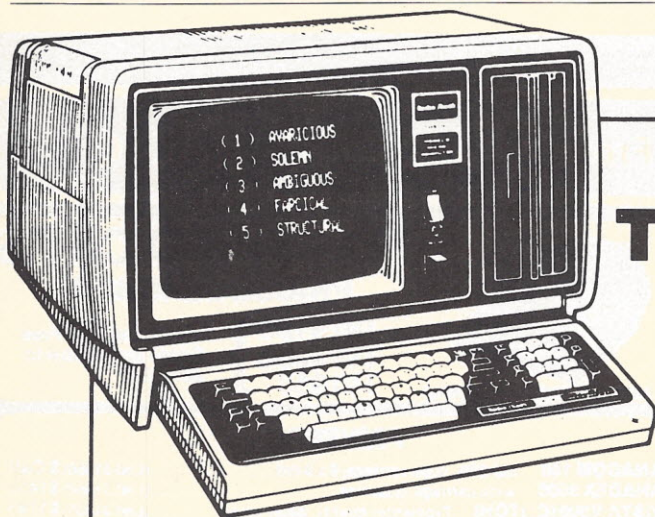
Instructor gradebook for the Apple II records and reports individual and class performance for classes of up to 400 students, and statistically measures the effectiveness of teaching and evaluation techniques. Designed in accordance with standard grading practices, offers seven defined and two optional grading categories, (e.g., test, homework, quiz) which are then weighted by the user to produce final scores. Marks can be entered either as numbers or as letter grades. Price: \$169. Serendipity Systems Inc., 225 Elmira Rd., Ithaca, NY 14850, (607) 277-4889.

CIRCLE INQUIRY NO. 381

Morse code tutorial for the Atari 400/800 with 16K RAM was designed to make learning

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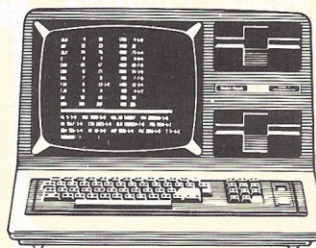


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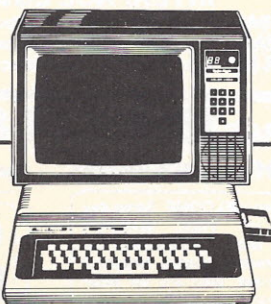
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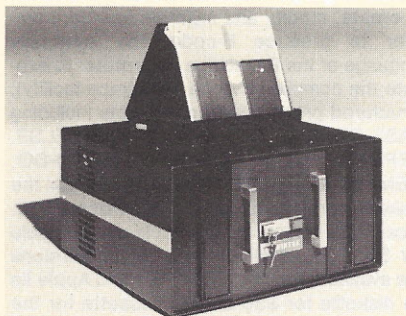
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the Morse code as easy as possible. Unlike traditional methods (records and tapes), this system helps diagnose the source of the students learning difficulties and give him positive feedback. Additionally, the use of randomization techniques eliminates any possibility of repetitive material. The student learns Morse at his own pace and can use any of four practice options to gain speed and accuracy. This program prepares the student for FCC code tests. Price: \$29.95. Macrotronics, Inc., 1125 N. Golden State Blvd., Turlock, CA 95380, (209) 667-2888. **CIRCLE INQUIRY NO. 382**

Math enrichment programs are designed for use by high school students or older. Programs are varied—The Riemann Integral, Pythagorean Proofs, geometric constructions, math puzzles and illusions. History and theory are a part of most of these, as well as a variety of intellectual challenges. Color graphics and student control characterize these programs. Each is designed to run on the Apple II computer equipped with 32K, Applesoft in ROM, and a single disk unit. Prices: \$29.95-\$34.95. Micro Power and Light Co., 1444 Keystone Park, 13773 N. Central Expwy., Dallas, TX 75243, (214) 234-8233. **CIRCLE INQUIRY NO. 384**

SYSTEMS

Fortran compiler for Wintek's Sprint 68 development system operates in the UCSD system software environment that includes an operating system, editor, assembler and



an operating system, editor, assembler and UCSD Pascal. Assembly language and Pascal programs can be linked with Fortran programs. Price: \$675. Wintek Corp., 1801 South St., Lafayette, IN 47904, (317) 742-8428. **CIRCLE INQUIRY NO. 394**

IBM-compatible compiler, RPG II, is designed to run on any Cromemco computer system with a minimum of 64K bytes of memory. It is a powerful business-oriented programming language, describing reporting requirements rather than being aimed primarily towards computer procedures. Routine report and file updating jobs can be programmed and debugged very quickly. It is designed for conciseness and ease of use. Only a few commands are needed to create and maintain files and to generate reports. For more complex applications, the language has a complete range of advanced commands that make it as versatile and powerful a language as Cobol. The language supports sequential, indexed-sequential and direct-access disk files. The compiler also contains powerful table and array-handling facilities. It is available on either 5-in. floppy diskette

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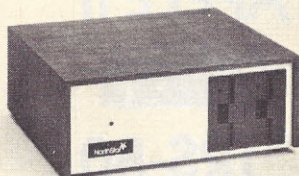
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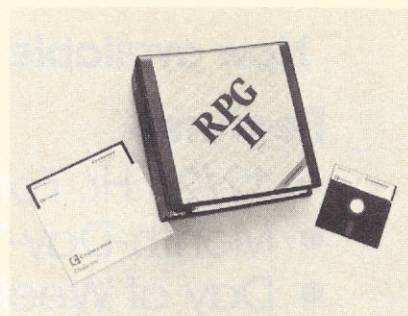
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CIRCLE INQUIRY NO. 397

File management system, Magsam, enables users to develop Basic programs utilizing powerful keyed file structures. Magsam III, written in Basic, supports multi-keyed files with any number of keys, and is available for CBasic and Microsoft Basic. Magsam IV, written in 8080-assembler, offers the same array functions as Magsam III, with faster access times. It is supplied with an interface for CBasic. Micro Applications Group, 7300 Caldas Ave., Van Nuys, CA 91406.
CIRCLE INQUIRY NO. 400

Disk operating system for the Apple II, Apex, provides the user with a complete program development and file management system. A comprehensive command set allows the user to perform almost any imaginable disk operation, yet a powerful default structure eliminates the typing of frequently used file names and complex command strings. The basic package includes all of the necessary tools for a complete assembly language development system. The package includes a high speed two pass resident assembler and a powerful macro editor. The assembler generates an alphabetized symbol table, a cross reference table and is capable of assembling over 1900 lines per minute. The editor has 18 commands, 10 text buffers and is capable of performing the most complex editing tasks. The complete package comes with operating system, assembler, editor and nearly 200 pages of comprehensive documentation for only \$99. Also available to run under Apex are a Focal emulation line interpreter for \$59, and Xplo, a block structures system language resembling Pascal for \$79. Apparatus, Inc., 4401 S. Tamarac Parkway, Denver, CO 80237, (303) 741-1778.
CIRCLE INQUIRY NO. 402

Menu driven program supports links with timeshare and other CP/M systems. Disk buffer allocates to available RAM. Terminal mode feature: session log to disk. File transfer modes perform auto disk page without data loss: XON/XOFF or CRC 16 protocol. Supports acoustic and auto dialing modems. Local mode disk dir, rename, delete, login, console echo, control display, session log. Prices: \$250, source; \$75, object. Hawkeye Grafex, 23914 Mobile, Canoga Park, CA 91307, (213) 348-7909.
CIRCLE INQUIRY NO. 403

Operating system, Oasis 5.5 multi-user Spooler, allows maximum printing efficiency. Twenty-six user-defined queues can be used to prioritize waiting jobs, automatically reprint multiple copies, or execute special forms such as checks or invoices. Archive and Restore, a sophisticated Oasis back-up utility, can be used to protect even very large amounts of disk data on cartridge or multiple floppies. Special benefits include compressing data to save storage space, read-back check, and many flexible archive options. Designed especially for files that are often updated but rarely accessed sequentially, new keyed files can be retrieved and updated much faster than existing Oasis direct, sequential and Isam files, and use less disk overhead in the process. Other features include unique flexibility in maintaining public, private or shared files with versatile security and accounting controls; file locking and automatic record locking to insure data integrity; convenient inter-user communications; a general purpose text editor; and comprehensive program development support. Prices: \$500 for single-user and \$850 for multi-user versions. Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA 94621, (415) 562-8085.
CIRCLE INQUIRY NO. 404

Tiny Pascal Plus ± for Pet and Apple II is an enhanced version of Tiny Pascal with support for graphics. It runs on 32K Pets and Apple IIs with Applesoft in ROM. It is available for immediate delivery. It is a complete package allowing the user to create, compile and execute programs written in the Pascal language. Features include: line editor to create, modify and maintain source; compiler to produce P-code, the assembly language of the P-machine; interpreter to execute the compiled P-code (with trace facility); structured programming constructs including CASE-OF-ELSE, WHILE-DO, IF-THEN-ELSE, REPEAT-UNTIL, FOR-TO/DOWNT0-DO, MEM, CONST, VAR, ARRAY. Prices for the diskette versions for Apple II and Pet are \$50. A cassette version for the Pet is also available for \$55. The original non-graphics versions are available for 16K/ 32K Pets and Apple IIs on diskette for \$35 and on cassette for the Pet for \$40. Abacus Software, P.O. Box 7211, Grand Rapids, MI 49510.
CIRCLE INQUIRY NO. 406

UTILITY

Programming language, AlphaPascal, is expressly developed for the Alpha Micro Business Computer. Fully integrated into the multi-user, multi-tasking, timesharing Alpha Micro operating system, it supports both sequential and random data files. It is also compatible with Alpha Micro's AlphaBasic language. It has the ability to separately compile and link Pascal modules to form one program, easing the task of developing and maintaining programs. Other features include the ability to add user-defined routines to an external library where other Pascal programmers can make use of them; the ability to call external assembly language sub-routines; full 11-digit accuracy for real variables; and labeling of BEGIN-END blocks. Alpha Micro, 17881 Sky Park N., Irvine, CA 92713, (714) 957-1404.
CIRCLE INQUIRY NO. 407

Cobol compiler for use with Intel's 8086 provides greatly increased Cobol computing power. The 8086 is a 16-bit micro with the ability to address up to 1 Mbyte of memory. CIS Cobol uses the 8086 segment register to address the total memory space and permit memory sharing in multiuser systems. Micro Focus, Inc., 1601 Civic Center Dr., Santa Clara, CA 95050, (408) 984-6961.
CIRCLE INQUIRY NO. 414

Z8000 Basic interpreter makes use of fully dynamic string allocation with garbage collection when needed. This gives the programmer the maximum possible area for variable and string storage with maximum length of a string being 64K. Powerful string handling functions such as substrings and character access are included. All math functions are performed to a full thirteen BCD digits of precision to eliminate rounding errors. These features make the Basic an excellent choice for business and scientific applications. Some of the powerful built-in BCD math functions implemented include SIN, COS, TAN, LOG, EXP, INT, FAC, SQR. Both sequential and random input/output operations are available with a logical and straightforward syntax. It supports the most popular Basic language syntax with many extensions. Price: \$500. SuperSoft Assoc., 40 Main St., Suite 402, Champaign, IL 61820, (217) 359-2112.
CIRCLE INQUIRY NO. 415

Color computer software disassembler runs on the Radio Shack Color Computer and enables you to generate your own source listing of the Basic interpreter ROM. Includes a documentation package that gives useful

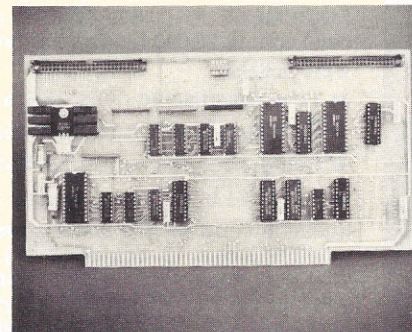
ROM entry points, complete memory map, I/O hardware details and more. Features include cross-referencing of variables and labels; output code that can be reassembled; output to an 80-column printer, small printer or screen; and a data table area specification that defaults to the table boundaries in the interpreter ROM. A 16K system is required for the cassette. Price: \$49.95. Micro Works, P.O. Box 1110, Del Mar, CA 92014, (714) 942-2400.
CIRCLE INQUIRY NO. 416

Information retrieval program, Information Master, handles a large body of rather static information where flexible access is required. This is accomplished by creating a compact index to the text files based on key words or phrases designated by the user. The text files containing the data to be retrieved may be created with any CP/M compatible text editor or user program in a free form format. The main program maintains a dictionary of all key words indexed, and searches the index on Boolean (and & or) combinations of key words. Retrieved data can be displayed, printed or written to another file. An invalid key word entry, when retrieving data, will cause the program to display a group of key words which are in the dictionary and are alphabetically close to the invalid entry. This is called the 'close to' feature, which allows the user to guess his way to the information desired. 1500 key-words, averaging ten characters each can be handled with 48K of memory. More than 6000 entries averaging 10 key words each can be indexed on a single 8-in. disk. Price: \$37.50 plus \$1.50 for shipping and handling.

Elliam Assoc., 24000 Bessemer St., Woodland Hills, CA 91367.

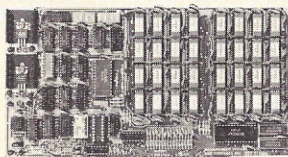
CIRCLE INQUIRY NO. 418

Controller/software package, TS-100, permits any IBM-compatible 9-track formatted tape drive, to be interfaced with the S-100 bus. MTIP software provides backup/restore under CP/M and MP/M operating systems. An .ASM file containing the tape control subroutines is included to facilitate customization. Linked via 16 I/O ports with switch selectable base addressing, the controller handles up to 25 IPS @ 1600 BPI or 50 IPS @ 800 BPI, and also supports bidirectional



spacing at 100 IPS. Software requires a 4 MHz Z-80, 8080, or 8085 bus processor, and is distributed on single sided, single density 8-in. floppy disk in CP/M format. Unit price: \$600, including software, and dual 8 ft. data cables with 50 pin connectors. Alloy Engineering Co., Inc., Computer Products Div., 85 Speen St., Framingham, MA 01701, (617) 620-1710.

CIRCLE INQUIRY NO. 419



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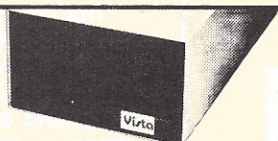
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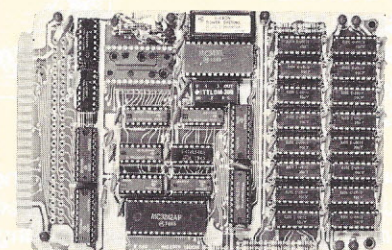
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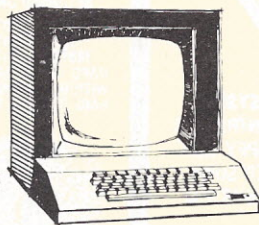
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CIRCLE INQUIRY NO. 33

BOOK REVIEWS

CRT Controller Handbook

by Gerry Kane

Osborne/McGraw-Hill, Berkeley, CA

Reviewed by Rocky Smolin

This is a highly specialized work aimed directly at designers of CRT-based displays and terminals. The internals of any CRT can be greatly simplified by employing one of the LSI controller devices described. They all perform essentially the same function—the generation and display of alphanumeric characters on a CRT screen. All controller devices described are oriented towards alphanumeric displays where data comprising a character line is repetitively presented to character generator logic.

Even for non-designers, the first chapter is interesting and informative. It is a tutorial explaining the principles of CRT operation beginning with the CRT screen, proceeding through the controller-monitor interface, the character generator, manipulation of CRT screen data and the CRT timing chain.

Each succeeding chapter thoroughly describes the functions of the CRT controller devices available: National Semiconductor (DP8350), Intel (8275), Motorola (6845), Sybertek (6545) and SMC/Texas Instruments (5027/9927).

The topics covered in each chapter are similar: a description of the controller pins and signals, the controller's programmable registers, the interfaces with the microprocessor system, character generator, monitor, and/or screen memory and programming of the controller. Included in each chapter are the data sheets and the address of the manufacturer.

The book will be invaluable for the designer or hobbyist. It follows the same standard format used in all of the Osborne handbook series and can be used as a supplement to 'An Introduction to Microcomputers, Volume 3.'

116 pages \$5.95

Physicians' Primer on Computers

—Private Practice

by Jan F. Brandeys, Ph.D. and Graham Pace, M.D.
Lexington Books, Lexington, MA

Reviewed by Bruce Evans, M.D.

The purpose of this book is to introduce nontechnically-oriented physicians to the concept of computer management in medical and business practices. Professional programmers are seldom intimately familiar with the businesses for which they write software, whether it be inventory or accounting programs; Dr. Brandeys and Dr. Pace are at home in either field.

The first two chapters define the problems in running a medical practice, repeatedly warning that trying to slip in a number of standard business routines such as accounts payable and payroll will not satisfy the potential buyer. Only those who have actually practiced medicine in a private office can appreciate the fact that people are harder to deal with than inventories of nuts and bolts.

An excellent chapter deals with the human side of medical practice—the patients, office staff and, worst of all, the physicians. Omit this chapter at your own peril. It is fun to sit home and go through countless attempts to run your program or debug it; it is disastrous for nontechnical people to do this in a business environment. All programs must be self-explanatory and absolutely goof-proof.

The meat of the book is the section telling what the computer should do for office practice, presented from a physician-user's point of view. It tells how the doctor should change his history-taking methods to incorporate all the advantages that a computer can offer. The authors' ideas on

data base management alone justify the use of a computer in a medical office.

The final section details how to gradually implement computer based operations into an office, from planning to actual operation. This can be very useful to anyone hoping to market a comprehensive system.

180 pages \$12.95

**Your First Computer:
A Guide to Business and Personal Computing
by Rodney Zaks
Sybex, Berkeley, CA**

Reviewed by Dennis Doonan

Anyone considering the purchase of a personal computer or business system is faced with an apparently overwhelming set of considerations. This book shows that the criteria are simple if the limitations imposed by the selection are understood.

It is for readers with little technical background or exposure to computers. Topics are simplified, clearly defined and easy to follow. The reader is shown the elements of a system, the human considerations, and business considerations of specific applications.

The first part describes the individual elements and internal operations and shows how they combine to form a system. It shows what a computer can do for specific applications.

An introduction to programming begins with machine language and leads to the popular high-level languages used by most readers. Basic, Fortran, Pascal and Cobol are all briefly reviewed.

A chapter realistically simulates, from start to finish, a typical working session with a mailing list and word processor package. This hands-on experience gives the reader an idea of the operation of a typical small business system, its capabilities and requirements.

In the first selection of a system, compromises are made to attain the desired capabilities. This book explains some of these trade-offs and helps avoid costly mistakes in the selection of a system or software package.

The last section summarizes the general criteria for selecting the system and its peripherals. Some popular models are described in terms of intended usage.

258 pages \$7.95

**Z8000 Assembly Language Programming
by Lance A. Leventhal, Adam Osborne, and Chuck Collins
Osborne/McGraw-Hill, Berkeley, CA**

Reviewed by Roland H. Alden

This massive book provides a wealth of information about the Z8000, and assembly language programming in general. The Z8000 is one of the new-generation 16-bit microprocessors. These new computers-on-a-chip offer substantial improvements in computational power over the earlier 8-bit chips.

The book provides a comprehensive introduction to the architecture of both the Z8001 and Z8002 VLSI microprocessors manufactured by Zilog. It will interest anyone as a general introduction to computer architecture because of the unusual tutorial style. Parts of the book are printed in boldface type, and the detailed information is printed in regular type. This is done so well that it is actually possible to go through the entire book reading only boldface type to get an overview.

The dedicated reader will find that closer inspection reveals all the detail one would want. After a general introduction to assembler programming, the book dives into a dis-

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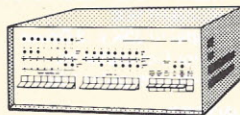
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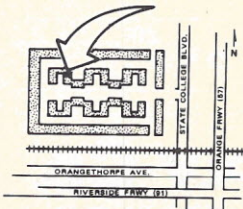
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CIRCLE INQUIRY NO. 87

BOOK REVIEWS

cussion of the Z8000 instruction set by general types of instructions and programming techniques. Following this useful and informative section is a copious presentation of every instruction, examples of usage, and the syntax used in the Zilog and AMC assemblers.

The next section contains actual program listings and should interest anyone who programs computers in assembly (machine) language.

The final section covers software development including program design, debugging and testing, and documentation. Two simple projects are used to illustrate the principles outlined.

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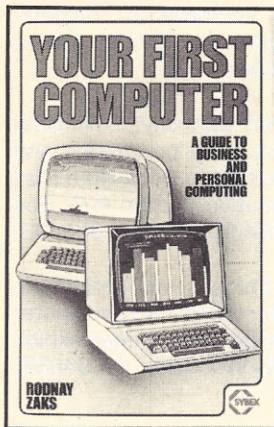
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by Rodnay Zaks

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The 8080A Bugbook: Microcomputer Interfacing and Programming

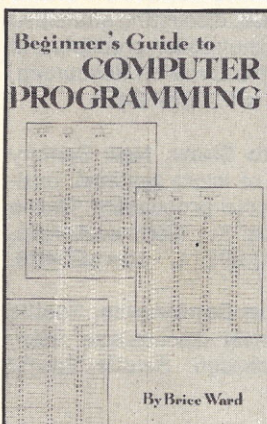
by Peter R. Rony, David G. Larsen, and Jonathan A. Titus

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The principles, concepts, and applications of an 8-bit microcomputer based on the 8080 microprocessor IC chip. The emphasis is on the computer as a controller. Intended to help develop the skills needed to use an 8080-based breadboard microcomputer system.



Beginner's Guide to Computer Programming

by Bruce Ward

Order No. 13,003

480 pages

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A primer for learning computer programming from the ground up. Instead of attempting to explain programming in terms of language, the author pursues his subject from the viewpoint of program requirements. Instead of working backward from a language, the book begins by developing a simple programming language of its own, determines a need, then gives the instruction.



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Apr 1-8 Hanover Fair '81, Hanover, Germany, exhibitions of microcomputers, word processors, data processing and office equipment. Interface Age will exhibit in Oebit-Nord (Hall 1), Stand A-503. Hanover Fair Information Center, P.O. Box 338, Whitehouse, NJ 08888, (201) 534-9044, Telex 833493.

Apr 3-5 West Coast Computer Faire, Civic Auditorium, San Francisco, CA, seminars on interesting microcomputer applications and projects and wide range of equipment exhibitions. Computer Faire, 333 Swett Rd., Woodside, CA 94062, (415) 851-7075.

Apr 4 Annual RAMS Computer Show, Perinton Square Mall, Fairport, NY, annual exposition of the Rochester Area Microcomputer Society including introduction of a computer bulletin board system, graphics, music, games and programming techniques. RAMS, Box 90808, Rochester, NY 14609.

Apr 7-9 Electro/81 Film Theater, New York, NY, showing recent and notable engineering and general science films for an audience of technical executives. Dale Litherland, Suite 410, 999 N. Sepulveda Blvd., El Segundo, CA 90245.

Apr 28-30 International Telecommunications Forum, Concorde Lafayette Hotel, Paris, France, discussing strategies for suppliers and users in new telecommunication products and services. Dusty Rhodes, Arthur D. Little Decision Resources, Acorn Park, Cambridge, MA 02140, (617) 267-3456.

Apr 29-May 1 Manchester Micro Show, New Century Hall, Middlesex, England, exhibition of micro systems, business micros, personal computers, word processors. Online Conferences Ltd., Argyle House, Joel St., Northwood Hills, HA6 ITS, Middlesex, England, (09274) 28211, Telex 923498.

May 1-2 Computers in Education Conference, Seattle Pacific University, Seattle, WA, panel discussions, talks, workshops, and exhibits. Jerry Johnson, Seattle Pacific University, Seattle, WA 98119.

May 5-8 PICA '81, Marriott Motor Inn, Philadelphia, PA, conference on power industry computer applications. T.A. Suman, Philadelphia Electric Co., 2301 Market St. N3-1, Philadelphia, PA 19101, (215) 841-6397.

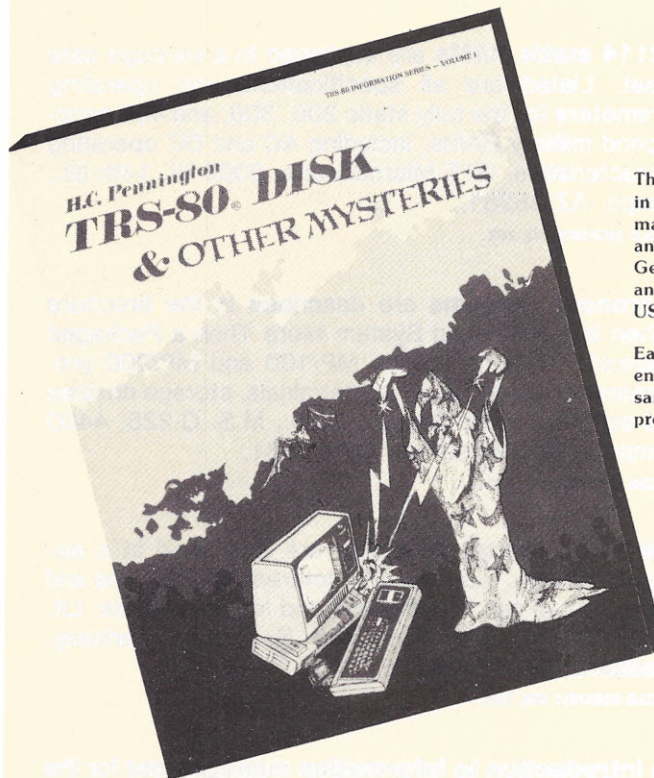
May 10-13 European Consumer Electronics Show, Nuremburg Fair Centre, Nuremburg, W. Germany, exhibitors from all over the world, including U.S., Japan, Europe, and the Far East, offer a complete range of electronic equipment for business and consumer use. Tom May, Industrial and Trade Fairs, Ltd., Radcliffe House, Bleaheim Ct., Solihull, West Midlands B91 2BG, England, (021) 705-6707, Telex: 337073.

May 26-29 Korea International Office Management Exposition, Exhibition Center, Seoul, Korea, computers, facsimile systems, copiers and duplicators. Clapp and Poliak, Int'l., 7315 Wisconsin Ave., Washington, D.C. 20014, (301) 657-3090.

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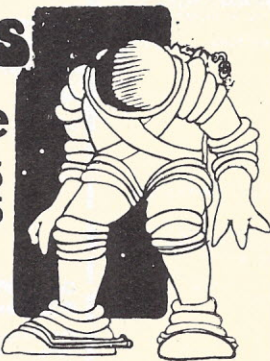
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Free Literature

LSI-11 reliability program is outlined in a 14-page brochure. It is directed at maximizing product reliability proportionate with performance requirements and design constraints. Digital Equipment Corp., One Iron Way, Marlboro, MA 01752.

CIRCLE INQUIRY NO. 201

M2114 static RAMs are explained in a six-page data sheet. Listed are all specifications and operating parameters for the fully static 200, 300, and 450 nano-second military RAMs, including AC and DC operating characteristics. GTE Microcircuits, 2000 W. 14th St., Tempe, AZ 85281.

CIRCLE INQUIRY NO. 202

Micronova systems are described in the brochure 'When is a Packaged System More Than a Packaged System?'. Options for the MP/100 and MP/200 processors are listed, including terminals, storage devices and software. Data General Corp., M.S. C-228, 4400 Computer Dr., Westboro, MA 01581.

CIRCLE INQUIRY NO. 203

Industrial digital switches are described in a six-page brochure. Included are pictures, descriptions and basic data of ten thumbwheel and lever switches. Lit. #1-0074C. Digitran Co., 855 S. Arroyo Parkway, Pasadena, CA 91105.

CIRCLE INQUIRY NO. 204

An introduction to information management for the small businessman who is contemplating use of an information system or expansion of a small system. Clapp and Poliak, Inc., 245 Park Ave., New York, NY 10067.

CIRCLE INQUIRY NO. 205

Electronic mail and message system is described in a two-page brochure. Offered are entry and intermediate levels of electronic mail, as well as significant enhancements to existing advanced-level capabilities. Wang Laboratories, One Industrial Ave., Lowell, MA 01851.

CIRCLE INQUIRY NO. 206

Software catalog of interest to engineers and surveyors lists surveying and subdivision geometry programs and others for industrial applications. Microcomp, Box 965, Solana Beach, CA 92075.

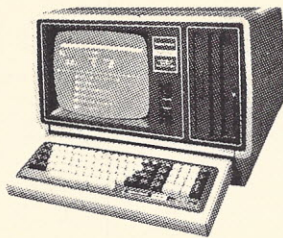
CIRCLE INQUIRY NO. 207

Low noise transistors are detailed in a catalog of 15 small signal devices. Specifications, performance graphs, photographs, circuit diagrams, package drawings and dimensions are included. All devices in the catalog are NPN silicon bipolar transistors with gold metallization. TRW RF Semiconductors, 14520 Aviation Blvd., Lawndale, CA 90260.

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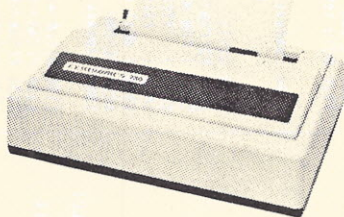
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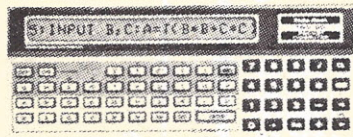
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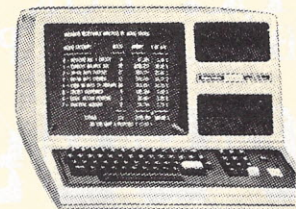
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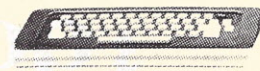
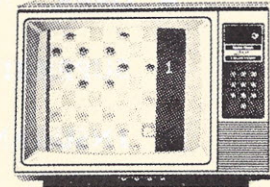
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Programming a New Car Purchase continued from page 99

Program listing

```
10 CLEAR 1000
20 DIM TT(2,8),REPAIR$(9),TT$(8),N$(2),TR(2),TY(2),HPG(2),G1(2),N(2),N2(2),P2(2),P(2),V(2),R(2)
30 F$="*****.##"
40 G1=12
50 N$(1)="PRESENT CAR"
60 N$(2)="REPLACEMENT CAR"
70 GOTO 110
80 CLS:PRINT:PRINT
90 RETURN
100 ***** READ TYPES OF REPAIRS INTO ARRAY *****

110 : FOR N1=1 TO 9
120 :   READ REPAIR$(N1)
130 : NEXT N1
140 ***** READ EXPENSE CATEGORY TYPES INTO ARRAY *****

150 : FOR N1=1 TO 8
160 :   READ TT$(N1)
170 : NEXT N1
180 DATA TIRES,BRAKES,EXHAUST SYSTEM,TUNE UP, ANTI FREEZE,ENGINE REPAIR,BODY OR PAINT WORK,ELECT
190 DATA GAS COST,DEPRECIATION,INSURANCE,REPAIRS,REGISTRATION,INTEREST,TOTAL COST,COST PER MILE
200 ***** LOOP TO INPUT DATA ON PRESENT, REPLACEMENT CAR *****

210 : FOR CAR=1 TO 2
220 :   GOSUB 80
```

```
890 GOSUB 80
900 GOSUB 1110
910 IF CAR=2 GOTO 1030
920 ***** CALCULATE REMAINING BALANCE ON PRESENT CAR *****
```

```
930 GOSUB 80
940 INPUT "HOW MANY MONTHS HAS THIS LOAN RUN TO DATE";ML
950 MTG=N2(CAR)-ML:P1=V(CAR)
960 : FOR N6=1 TO ML
970 :   P1=P1*(1+R(CAR)/12)-P(CAR)
980 : NEXT N6
990 IF MTG<G1 THEN G1=MTG
1000 P2(CAR)=P1
1010 GOTO 1050
```

```
1020 ***** CALCULATE INTEREST FOR NEXT 12 MONTHS, OR TO END
      OF LOAN, WHICHEVER IS LESS *****
```

```
1030 G1=12
1040 P2(CAR)=V(CAR)
1050 : FOR N7=1 TO G1
1060 :   TT(CAR,6)=TT(CAR,6)+P2(CAR)*R(CAR)/12
1070 :   P2(CAR)=P2(CAR)*(1+R(CAR)/12)-P(CAR)
1080 : NEXT N7
1090 RETURN
1100 ***** CALCULATE MONTHLY PAYMENTS *****
```

```
1110 R(CAR)=R(CAR)/100;G(CAR)=(1+R(CAR)/12)^(N(CAR)*12)
1120 P(CAR)=(R(CAR)*V(CAR)*G(CAR))/(G(CAR)-1)
1130 P(CAR)=P(CAR)/12
1140 P(CAR)=INT(100*(P(CAR)+.005))/100
1150 RETURN
```

APRIL 1987


```

230 : PRINT "ENTER VALUE OF ";N$(CAR);
240 : INPUT TR(CAR)
250 : GOSUB 80
260 : GOSUB 780
270 : GOSUB 80
280 : PRINT "ENTER ESTIMATED TRADE-IN VALUE IN ONE YEAR :";
290 : INPUT TY(CAR)
300 : TT(CAR,2)=TR(CAR)-TY(CAR)
310 : GOSUB 80
320 : PRINT "ENTER MPG OF ";N$(CAR);
330 : INPUT MPG(CAR)
340 : GOSUB 80
350 : PRINT "ENTER YEARLY INSURANCE FOR ";N$(CAR);
360 : INPUT TI(CAR,3)
370 : GOSUB 80
380 : PRINT "ENTER REGISTRATION COST FOR ";N$(CAR);
390 : INPUT TT(CAR,5)
400 : GOSUB 80
410 : PRINT "WILL ";N$(CAR); " NEED REPAIRS IN THE NEXT 12 MONTHS?"
420 : INPUT AN$
430 : IF LEFT$(AN$,1)="N" GOTO 510
440 : GOSUB 80
450 : PRINT "ENTER ESTIMATES OF COST : "
460 :   FOR N2=1 TO 9
470 :     PRINT REPAIR$(N2);
480 :     INPUT R2
490 :     TT(CAR,4)=TT(CAR,4)+R2
500 :   NEXT N2
510 : NEXT CAR

520 / ***** INPUT DATA THAT APPLIES TO BOTH CARS *****

530 GOSUB 80
540 INPUT "ENTER NUMBER OF MILES TO BE DRIVEN IN NEXT 12 MONTHS";MILES
550 GOSUB 80
560 INPUT "ENTER COST PER GALLON OF GAS ";GAS
570 / ***** CALCULATE TOTAL COSTS *****

580 : FOR N3=1 TO 2
590 :   G1(N3)=MILES/MPG(N3)
600 :   TT(N3,1)=G1(N3)*GAS
610 :   FOR N4=1 TO 6
620 :     TT(N3,7)=TT(N3,7)+TT(N3,N4)
630 :   NEXT N4
640 :   TT(N3,8)=TT(N3,7)/MILES
650 : NEXT N3
660 GOSUB 80
670 / ***** PRINT OUT RESULTS *****

680 PRINT, N$(1),N$(2)
690 PRINT
700 : FOR N5=1 TO 8
710 :   PRINT TT$(N5);
720 :   PRINT " ";
730 :   PRINT USING F$;TT(1,N5);
740 :   PRINT " ";
750 :   PRINT USING F$;TT(2,N5)
760 : NEXT N5
770 GOTO 770
780 / ***** FIGURE LOAN INTEREST EXPENSES FOR CARS *****

790 GOSUB 80
800 INPUT "HAS THIS CAR BEEN FULLY PAID FOR?";AN$
810 IF LEFT$(AN$,1)="Y" THEN RETURN
820 GOSUB 80
830 INPUT "ENTER AMOUNT BORROWED";V(CAR)
840 GOSUB 80
850 INPUT "ENTER INTEREST RATE";R(CAR)
860 GOSUB 80
870 INPUT "ENTER TOTAL MONTHS OF LOAN";N2(CAR)
880 N(CAR)=N2(CAR)/12

```

Variables used in TO BUY

AN\$	Stores Yes/No input
CAR	Loop counter for present/replacement cars
F\$	PRINT USING format
G1	Number of months used in calculating interest
G1(n)	Number of gallons of gas used in a year
GAS	Cost of gallon of gas
MILES	Number of miles driven in a year
ML	Months left in current car loan
MPG(n)	Miles per gallon
MTG	Months to go in current car loan
N	Number of months in loan
N\$(n)	Stores strings "Present Car", "Replacement Car"
N1-N7	Loop counters
P(n)	Monthly loan payments
P1	Stores temporary loan principal value
P2	Stores temporary loan principal value
R(n)	Loan interest rate
R2	Stores repair cost input
REPAIR\$(n)	Names of various repairs
TR(n)	Current value of car
TT(n)	Totals of expense categories
TY(n)	Trade-in value in one year
V(n)	Amount borrowed to finance

Sample run

```

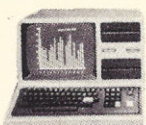
>RUN
ENTER VALUE OF PRESENT CAR? 2000
HAS THIS CAR BEEN FULLY PAID FOR? N
ENTER AMOUNT BORROWED? 1500
ENTER INTEREST RATE? 15
ENTER TOTAL MONTHS OF LOAN? 18

```


HOW MANY MONTHS HAS THIS LOAN RUN TO DATE? 12
 ENTER ESTIMATED TRADE-IN VALUE IN ONE YEAR :? 1500
 ENTER MPG OF PRESENT CAR? 24
 ENTER YEARLY INSURANCE FOR PRESENT CAR? 300
 ENTER REGISTRATION COST FOR PRESENT CAR? 15
 WILL PRESENT CAR NEED REPAIRS IN THE NEXT 12 MONTHS
 ? Y
 ENTER ESTIMATES OF COST :
 TIRES? 100
 BRAKES? 50
 EXHAUST SYSTEM? 120
 ANTI FREEZE? 10
 ENGINE REPAIR? 0
 BODY OR PAINT WORK? 0
 ELECTRICAL WORK? 0
 TRANSMISSION WORK? 0
 ENTER VALUE OF REPLACEMENT CAR? 6000
 HAS THIS CAR BEEN FULLY PAID FOR? N
 ENTER AMOUNT BORROWED? 4000
 ENTER INTEREST RATE? 15
 ENTER TOTAL MONTHS OF LOAN? 36
 ENTER ESTIMATED TRADE-IN VALUE IN ONE YEAR :? 4500
 ENTER MPG OF REPLACEMENT CAR? 35
 ENTER YEARLY INSURANCE FOR REPLACEMENT CAR? 400
 ENTER REGISTRATION COST FOR REPLACEMENT CAR? 15
 WILL REPLACEMENT CAR NEED REPAIRS IN THE NEXT 12 MONTHS
 ? N
 ENTER NUMBER OF MILES TO BE DRIVEN IN NEXT 12 MONTHS? 12000
 ENTER COST PER GALLON OF GAS ? 1.30

	PRESENT CAR	REPLACEMENT CAR
GAS COST	\$650.00	\$445.71
DEPRECIATION	\$500.00	\$1500.00
INSURANCE	\$300.00	\$400.00
REPAIRS	\$300.00	\$0.00
REGISTRATION	\$15.00	\$15.00
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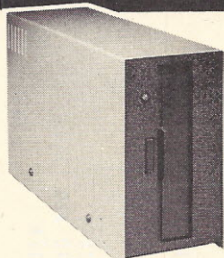
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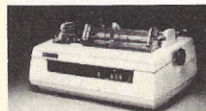
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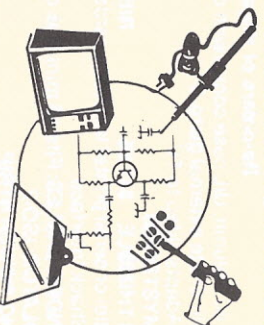
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152 INTERFACE AGE

Pathology Bookkeeper continued from page 105

Example 1

```
A>run index
BASIC-E INTERPRETER: VER K2.0
ON WHAT DRIVE IS THE DATA
? a
NOW ORGANIZING FILE a:A.DAT
NOW ORGANIZING FILE a:B.DAT
NOW ORGANIZING FILE a:C.DAT
NOW ORGANIZING FILE a:D.DAT
NOW ORGANIZING FILE a:E.DAT
NOW ORGANIZING FILE a:F.DAT
NOW ORGANIZING FILE a:G.DAT
NOW ORGANIZING FILE a:H.DAT
NOW ORGANIZING FILE a:I.DAT
NOW ORGANIZING FILE a:J.DAT
NOW ORGANIZING FILE a:K.DAT
NOW ORGANIZING FILE a:L.DAT
NOW ORGANIZING FILE a:M.DAT
```

```
10 TERMINAL = 1
   INPUT "DATA ON WHICH DRIVE";DRIVE$
   DRIVE$ = DRIVE$+" ";
110 GOSUB 2450:REM   CLEAR SCREEN
120 REM
130 GOTO 2290:REM   OPERATION LIST
140 REM
150 REM   ***** < INPUT RECORD > *****
160 GOSUB 2450
180 PRINT TAB(10);:INPUT "   NAME"           ";N$
190 IF LEN(N$)>18 THEN PRINT "INVALID":GOTO 180
200 RESTORE
210 A$=LEFT$(N$,1)
220 DATA A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z,"END"
230 READ A$
   IF A$="END" THEN PRINT "INVALID ENTRY":GOTO 180
240 IF A$=A$ THEN GOTO 250 ELSE GOTO 230
250 REM *****   INPUT ASSOCIATED DATA   *****
260 PRINT TAB(10);:INPUT "   ADDRESS"         ";D1$
270 IF LEN(D1$)>20 THEN PRINT "INVALID":GOTO 260
290 PRINT TAB(10);:INPUT "   CITY"            ";C$
300 IF LEN(C$) > 15 THEN PRINT "INVALID":GOTO 290
320 PRINT TAB(10);:INPUT "   STATE"           ";ST$
330 IF LEN(ST$)>2 THEN PRINT "TWO LETTERS ONLY":GOTO 320
340 PRINT TAB(10);:INPUT "   ZIP"             ";Z$
350 IF LEN(Z$)>5 THEN PRINT "INVALID":GOTO 340
```

APRIL 1981


```

NOW ORGANIZING FILE a:N.DAT
NOW ORGANIZING FILE a:O.DAT
NOW ORGANIZING FILE a:P.DAT
NOW ORGANIZING FILE a:Q.DAT
NOW ORGANIZING FILE a:R.DAT
NOW ORGANIZING FILE a:S.DAT
NOW ORGANIZING FILE a:T.DAT
NOW ORGANIZING FILE a:U.DAT
NOW ORGANIZING FILE a:V.DAT
NOW ORGANIZING FILE a:W.DAT
NOW ORGANIZING FILE a:X.DAT
NOW ORGANIZING FILE a:Y.DAT
NOW ORGANIZING FILE a:Z.DAT
INDEX FILES SUCCESSFULLY CREATED FOR DOCTOR & PATHOLOGY

```

```
A>TYPE PATHINDEX.DAT
```

```

"ACNE","B",1
"COLD","B",2
"MEASLES","B",3
"EAR INFECTION","E",1
"HEART ATTACK","S",1
"APPENDECTOMY","S",2
"APPENDECTOMY","T",1
"HEAD INJURY","W",1

```

```
A>
```

Listing 1

```

REM PROGRAM NAME <PATHRAN>
REM PROGRAM FUNCTION (PATHOLOGY RANDOM FILE)
REM FROM INTERFACE AGE, NOVEMBER 1979, PAGE 61
REM
REM MODIFIED BY GLENN STOK - DECEMBER 1979:
REM - TRANSLATED TO BASIC-E
REM - ADDED CODE FOR INTERTUBE CURSOR CONTROL
REM - ADDED TRUE INDEXING FOR RANDOM ACCESS.
REM - WROTE ACCOMPANYING PROGRAM TO CREATE INDEX FILES.
REM
REM EQUIPMENT
REM INTERTUBE CONSOLE
REM Z-80 CPU
REM MEGABOX DUAL DISK
REM TELETYPE MODEL 43 PRINTER
REM BASIC-E (BASED IN CP/M)
REM
REM <<< CODED TO HANDLE BOTH SOROC AND INTERTUBE TERMINALS >>>
REM <<< SET TERMINAL = 1 FOR INTERTUBE, OR 2 FOR SOROC >>>

```

```

360 PRINT TAB(10);:INPUT " TELEPHONE # ";T$
370 IF LEN(T$)>10 THEN PRINT "INVALID":GOTO 360
380 PRINT TAB(10);:INPUT " AGE ";Y$
390 IF LEN(Y$)>2 THEN PRINT "INVALID":GOTO 380
400 PRINT TAB(10);:INPUT " SEX ";Q$
410 IF LEN(Q$) > 1 THEN PRINT "ONLY F or M":GOTO 400
420 PRINT TAB(10);:INPUT " DOCTOR ";G$
430 IF LEN(G$) > 1 THEN PRINT "Only first letter":GOTO 420
440 PRINT TAB(10);:INPUT " DATE OF SERGURY ";D$
450 IF LEN(D$) > 6 THEN PRINT "Format like < 023078 >":GOTO 440
460 PRINT TAB(10);:INPUT " LOCATION ";L$
470 IF LEN(L$) > 17 THEN PRINT "Too long":GOTO 460
480 PRINT TAB(10);:INPUT " PATHOLOGY ";P$
500 IF LEN(P$) > 20 THEN PRINT "Invalid":GOTO 490
510 PRINT TAB(10);:INPUT " STATUS ";C1$
520 IF LEN(C1$) > 12 THEN PRINT "Too Long":GOTO 510
530 F$ = A$ + ".DAT"
540 FILE$=DRIVE$+F$:FILE FILE$(150)
IF END #1 THEN 590
550 S = 1:REM Set record counter
570 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
580 IF RIGHT$(X$,1) <> "D" THEN S = S+1:GOTO 570
590 X$ = "A"
610 PRINT #1,S;X$,N$,D1$,C$,ST$,Z$,T$,Y$,Q5$,G4$,D5$,L$,P$,C1$
CLOSE 1:GOTO 2290
620 REM
630 REM ***** EDIT *****
640 REM
650 N$ = "H"
660 GOSUB 2450
670 INPUT "Patient's name";N$
680 A$ = LEFT$(N$,1)
690 RESTORE
700 READ A1$
IF A1$ = "END" THEN PRINT "INVALID":GOTO 670
710 IF A1$ = A$ THEN GOTO 720 ELSE GOTO 700
720 F$ = A$ + ".DAT"
730 FILE$=DRIVE$+F$:FILE FILE$(150)
740 S = 1
750 IF END #1 THEN 815
770 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
780 IF RIGHT$(X$,1) = "D" THEN S = S+1:GOTO 770
790 IF LEFT$(NN$,LEN(N$)) <> N$ THEN S = S+1:GOTO 750
800 GOSUB 2450
810 GOSUB 830:GOTO 1060
815 PRINT "*** < END OF FILE > ***":CLOSE 1:GOTO 2290
820 REM
830 REM ***** PRINT ROUTINE *****
840 REM
850 PRINT NN$;TAB(50);"AGE :";YR$
860 PRINT AD1$
870 PRINT CC$;",";T1$;",";ZZ$
890 PRINT
900 IF V5$ = "M" THEN V1$ = "MALE":GOTO 920

```



```

910 V1$ = "FEMALE"
920 PRINT "TELEPHONE :";LEFT$(TT$,3);"-";RIGHT$(TT$,4);
930 PRINT TAB(50);"Sex :";V1$
940 PRINT "Treating Doctor :";G5$
990 PRINT
1000 PRINT "Date of Surgery : ";LEFT$(W5$,2);"/";MID$(W5$,3,2);\
      "/" ;RIGHT$(W5$,2)
1010 PRINT "Pathology - ";PP$
1020 PRINT "Location - ";LL$
1030 PRINT
1040 PRINT "Patient Status :";CN1$
1050 RETURN
1060 PRINT
1080 INPUT "Want to change this information";YN$
1090 IF LEFT$(YN$,1) <> "Y" THEN S = S+1:GOTO 750
1100 PRINT:PRINT "TYPE 'Y' OR CORRECT ENTRY:"
1110 INPUT "Correct name";N$
1120 IF N$ = "Y" THEN N$ = NN$
1130 INPUT "Correct address";D1$
1140 IF D1$ = "Y" THEN D1$ = AD1$
1150 INPUT "Correct city";C$
1160 IF C$ = "Y" THEN C$ = CC$
1170 INPUT "Correct State";ST$
1180 IF ST$ = "Y" THEN ST$ = T1$
1190 INPUT "Correct Zip";Z$
1200 IF Z$ = "Y" THEN Z$ = ZZ$
1210 INPUT "Correct Telephone #";T$
1220 IF T$ = "Y" THEN T$ = TT$
1230 INPUT "Correct Age";Y$
1240 IF Y$ = "Y" THEN Y$ = YR$
1250 INPUT "Correct Sex";Q5$
1260 IF Q5$ = "Y" THEN Q5$ = V5$
1270 INPUT "Correct Doctor";G4$
1280 IF G4$ = "Y" THEN G4$ = G5$
1290 INPUT "Correct Pathology";P$
1300 IF P$ = "Y" THEN P$ = PP$
1310 INPUT "Correct Location";L$
1320 IF L$ = "Y" THEN L$ = LL$
1330 INPUT "Correct Date of Surgery";DS$
1340 IF DS$ = "Y" THEN DS$ = W5$
1350 INPUT "Correct Patient Status";C1$
1360 IF C1$ = "Y" THEN C1$ = CN1$
1380 PRINT #1,S;X$,N$,D1$,C$,ST$,Z$,T$,Y$,Q5$,G4$,DS$,L$,P$,C1$
      CLOSE 1:GOTO 2290
1390 REM
1400 REM ***** PRODUCE INDEX *****
1410 REM
1420 REM
1430 GOSUB 2450
1440 PRINT "Type < ALL > for complete index"
1450 INPUT "Index for what letter";A$
1470 IF A$ = "ALL" THEN GOTO 1660
1480 A$ = LEFT$(A$,1)

```

```

1970 S=S+1:GOTO 1940
1980 GOSUB 2450
1990 PRINT "Sector : ";S
2000 PRINT "-----"
2010 GOSUB 850:X=24:Y=60:GOSUB 3010
2015 INPUT "ENTER 'E' TO END";A$
2020 IF LEFT$(A$,1) = "E" THEN CLOSE 1:GOTO 2290
2030 S=S+1:GOTO 1940
2035 PRINT "< END OF FILE >":CLOSE 1:GOTO 2285
2040 REM
2050 REM < DELETE DATA >
2060 REM
2070 GOSUB 2450
2080 INPUT "NAME OF PATIENT";N$
2090 A$=LEFT$(N$,1)
2100 RESTORE
2110 READ A1$
      IF A1$ = "END" THEN PRINT "INVALID":GOTO 2080
2120 IF A1$ = A$ THEN GOTO 2130 ELSE GOTO 2110
2130 S=0:INPUT "RECORD";S
2140 IF S <= 0 THEN PRINT "INVALID":GOTO 2130
      IF S > 2000 THEN PRINT "INVALID":GOTO 2130
2150 F$=A$+".DAT":FILE$=DRIVE$+F$:FILE FILE$(150)
2160 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
2170 IF LEFT$(NN$,LEN(N$)) <> N$ THEN PRINT "Name does not Match":CLOSE 1:\
      GOTO 2285
2180 GOSUB 2450
2190 GOSUB 850
2200 INPUT "Want to DELETE this Record";YN$
2210 IF LEFT$(YN$,1) <> "Y" THEN GOTO 2290
2220 LET X$ = "D"
2250 PRINT #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
      CLOSE 1:GOTO 2290
2260 REM
2270 REM ***** OPERATION LIST *****
2280 REM
2285 X=24:Y=76:GOSUB 3010:INPUT " ";
2290 GOSUB 2450:PRINT "      PATIENT DATA"
2300 PRINT
2310 PRINT "-----"
2320 PRINT
2330 PRINT "      1 - ENTER NEW PATIENT DATA"
2340 PRINT "      2 - EDIT DATA"
2350 PRINT "      3 - INDEX"
2360 PRINT "      4 - DELETE RECORD"
2370 PRINT "      5 - SEARCH BY PATIENT NAME"
2380 PRINT "      6 - SEARCH BY PATHOLOGY"
2390 PRINT "      7 - SEARCH BY DOCTOR"
2395 PRINT "      8 - END"
2400 FOR X = 1 TO 4:PRINT CHR$(10);:NEXT X
2410 INPUT "      ENTER #";C
2420 IF C < 1 THEN GOTO 2290
      IF C > 8 THEN GOTO 2290

```



```

1490 RESTORE
1500 READ A1$
    IF A1$ = "END" THEN PRINT "INVALID INDEX":GOTO 1420
1510 IF A1$ = A$ THEN GOTO 1520 ELSE GOTO 1500
1520 F$ = A$ + ".DAT"
1530 FILE$=DRIVE$+F$:FILE FILE$(150)
1540 S=1
1550 C=0:GOSUB 2450
1570 IF END #1 THEN 1625
1580 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
1590 IF RIGHT$(X$,1) = "D" THEN S = S+1:GOTO 1580
    PRINT S;TAB(5);NN$;TAB(40);PP$:C=C+1:S=S+1
1610 IF C=20 THEN GOTO 1620 ELSE GOTO 1580
1620 X=24:Y=60:GOSUB 3010:INPUT "ENTER 'E' TO END";J$
    IF J$ <> "E" THEN GOTO 1550 ELSE CLOSE 1:GOTO 2290
1625 PRINT:PRINT "END OF INDEX":CLOSE 1:GOTO 2285
1630 REM
1640 REM          PRINT COMPLETE INDEX
1650 REM
1660 RESTORE:C=0:W=1
1670 GOSUB 2450
1680 READ A1$
    IF A1$ = "END" THEN PRINT:PRINT "END OF INDEX":GOTO 2285
1690 F$ = A1$ + ".DAT"
1700 GOSUB 2940
1710 S=1
1720 FILE$=DRIVE$+F$:FILE FILE$(150)
1740 IF END #1 THEN 1795
1750 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
1760 IF RIGHT$(X$,1) = "D" THEN S=S+1:GOTO 1750
1770 C=C+1:PRINT S;TAB(5);NN$;TAB(40);PP$:S=S+1
1780 IF C < 20 THEN 1750
    C=0:X=24:Y=60:GOSUB 3010:INPUT "ENTER 'E' TO END";J$
    IF J$ = "E" THEN CLOSE 1:GOTO 2290
    GOSUB 2450:PRINT:PRINT:GOTO 1750
1795 CLOSE 1:GOTO 1680
1800 REM
1810 REM ***** GET ROUTINE *****
1820 REM
1830 GOSUB 2450
1840 INPUT "PATIENT'S NAME";N$
1850 A$=LEFT$(N$,1)
1860 RESTORE
1870 READ A1$
    IF A1$ = "END" THEN PRINT "INVALID":GOTO 1840
1880 IF A1$=A$ THEN GOTO 1890 ELSE GOTO 1870
1890 F$=A$ + ".DAT"
1900 FILE$=DRIVE$+F$:FILE FILE$(150)
1910 S=1
1920 IF END #1 THEN 2035
1940 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
1950 IF RIGHT$(X$,1) = "D" THEN S=S+1:GOTO 1940
1960 IF LEFT$(NN$,LEN(N$)) = N$ THEN GOTO 1980

```

```

2430 ON C GOTO 160,650,1420,2070,1830,2500,2730,2460
2440 GOTO 2290
2450 ON TERMINAL GOTO 2452,2454:REM *** CLEAR SCREEN ***
2452 PRINT CHR$(12):RETURN
2454 PRINT CHR$(27);CHR$(43):RETURN
2460 GOSUB 2450:STOP
2470 REM
2480 REM ***** SEARCH BY PATHOLOGY *****
2490 REM
2500 GOSUB 2450
2510 INPUT "WHAT <PATHOLOGY> ARE YOU SEARCHING";P$
2520 RESTORE
2530 C=0:W=1
2540 GOSUB 2450
2550 PRINT "Pathology being searched is < ";P$;" >":PRINT
    REM
    REM SEE IF FILE IS INDEXED BY PATHOLOGY - WILL GOTO EOF IF NOT.
    REM INDEX FILE RECORD: PATHOLOGY, IN-FILE, IN-RECORD
    INDEX = 0
    FILE$ = DRIVE$+"PATHINDX.DAT":FILE FILE$
    IF END #1 THEN 2555
2551 READ #1;PATH$,INFILE$,INREC
    INDEX = 1:REM - INDEX FILE EXISTS
    IF LEFT$(PATH$,LEN(P$)) <> P$ THEN 2551
    REM ** FOUND IT ** NOW GO GET IT **
    FILE$ = DRIVE$+INFILE$+".DAT":FILE FILE$(150)
    REM -- ERROR IF EOF --
    IF END #2 THEN 2552
    READ #2,INREC;X$,NN$,AD$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
    CLOSE 2
    IF X$ = "D" THEN 2551
    PRINT W;TAB(5);NN$;TAB(40);PP$:C=C+1:S=S+1:W=W+1
    IF C < 20 THEN 2551
    C=0:X=24:Y=60:GOSUB 3010:INPUT "ENTER 'E' TO END";J$
    IF J$ = "E" THEN CLOSE 1:GOTO 2290
    GOSUB 2450:PRINT:PRINT:GOTO 2551
2552 PRINT CHR$(12);"ERROR - INDEX FILE NEEDS TO BE REORGANIZED"
    PRINT "          TYPE 'RUN INDEX':STOP
2555 CLOSE 1
    IF INDEX = 1 THEN PRINT "END OF SEARCH":GOTO 2285
2560 READ A1$
    IF A1$="END" THEN PRINT:PRINT "END OF SEARCH":GOTO 2285
2570 F$ = A1$+".DAT"
2580 GOSUB 2940
2590 S=1
2600 FILE$=DRIVE$+F$:FILE FILE$(150)
2620 IF END #1 THEN 2695
2630 READ #1,S;X$,NN$,AD1$,CC$,T1$,ZZ$,TT$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
2640 IF RIGHT$(X$,1) = "D" THEN S=S+1:GOTO 2630
2650 P1$=LEFT$(PP$,LEN(P$))
2660 IF P1$ <> P$ THEN S=S+1:GOTO 2630
2670 PRINT W;TAB(5);NN$;TAB(40);PP$:C=C+1:S=S+1:W=W+1
2680 IF C < 20 THEN 2630
    C=0:X=24:Y=60:GOSUB 3010:INPUT "ENTER 'E' TO END";J$

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IF J$ = "E" THEN CLOSE 1:GOTO 2290
GOSUB 2450:PRINT:PRINT:GOTO 2630
2695 CLOSE 1:GOTO 2560
2700 REM
2710 REM ***** SEARCH BY DOCTOR *****
2720 REM
2730 GOSUB 2450
2740 INPUT "Which < DOCTOR > are you searching";D8$
2750 RESTORE
2760 C=0:W=1
2770 GOSUB 2450
2780 PRINT "Pathology being searched by Doctor < ";D8$;" >":PRINT
REM
REM SEE IF FILE IS INDEXED BY DOCTOR - WILL GOTO EOF IF NOT.
REM INDEX FILE RECORD: DOCTOR, IN-FILE, IN-RECORD
INDEX = 0
FILE$ = DRIVE$+"DOCRINDX.DAT":FILE FILE$
IF END #1 THEN 2795
2790 READ #1:DOCTOR$,INFILE$,INREC
INDEX = 1:REM - INDEX FILE EXISTS
IF LEFT$(DOCTOR$,LEN(D8$)) <> D8$ THEN 2790
REM ** FOUND IT ** NOW GO GET IT **
FILE$ = DRIVE$+INFILE$+".DAT":FILE FILE$(150)
REM -- ERROR IF EOF --
IF END #2 THEN 2552
READ #2,INREC:X$,NN$,AD$,CC$,T1$,ZZ$,T1$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
CLOSE 2
IF X$ = "D" THEN 2790
PRINT W;TAB(5);NN$;TAB(40);PP$:C=C+1:S=S+1:W=W+1
IF C < 20 THEN 2790
C=0:X=24:Y=60:GOSUB 3010:INPUT "ENTER 'E' TO END";J$
IF J$ = "E" THEN CLOSE 1:GOTO 2290
GOSUB 2450:PRINT:PRINT:GOTO 2790

2795 CLOSE 1
IF INDEX = 1 THEN PRINT "END OF SEARCH":GOTO 2285
2800 READ A1$
IF A1$="END" THEN PRINT:PRINT "No more found":GOTO 2285
2810 F$ = A1$ + ".DAT"
2820 GOSUB 2940
2830 S=1
2840 FILE$=DRIVE$+F$:FILE FILE$(150)
2860 IF END #1 THEN 2925
2870 READ #1,S:X$,NN$,AD1$,CC$,T1$,ZZ$,T1$,YR$,V5$,G5$,W5$,LL$,PP$,CN1$
2880 IF RIGHT$(X$,1) = "D" THEN S=S+1:GOTO 2870
2890 IF G5$ <> D8$ THEN S=S+1:GOTO 2870
2900 PRINT W;TAB(5);NN$;TAB(40);PP$:C=C+1:S=S+1:W=W+1
IF C < 20 THEN 2870
C=0:X=24:Y=60:GOSUB 3010:INPUT "ENTER 'E' TO END";J$
IF J$ = "E" THEN CLOSE 1:GOTO 2290
GOSUB 2450:PRINT:PRINT:GOTO 2870
2925 CLOSE 1:GOTO 2800
2930 REM

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2940 REM          ABSOLUTE CURSOR CONTROL
2950 REM
2960 X=1:Y=55
ON TERMINAL GOTO 2970,2980
2970 PRINT CHR$(27);"Y";CHR$(32+X);CHR$(32+Y);
PRINT " IN FILE < ";F$;" >"
PRINT CHR$(27);"Y";CHR$(34+C);CHR$(33)
RETURN
2980 PRINT CHR$(27);CHR$(61);CHR$(32+X);CHR$(32+Y);
PRINT " IN FILE < ";F$;" >"
PRINT CHR$(27);CHR$(61);CHR$(33+C);CHR$(33)
RETURN
3010 ON TERMINAL GOTO 3020,3030
3020 PRINT CHR$(27);"Y";CHR$(32+X);CHR$(32+Y);:RETURN
3030 PRINT CHR$(27);CHR$(61);CHR$(32+X);CHR$(32+Y);:RETURN
9999 END

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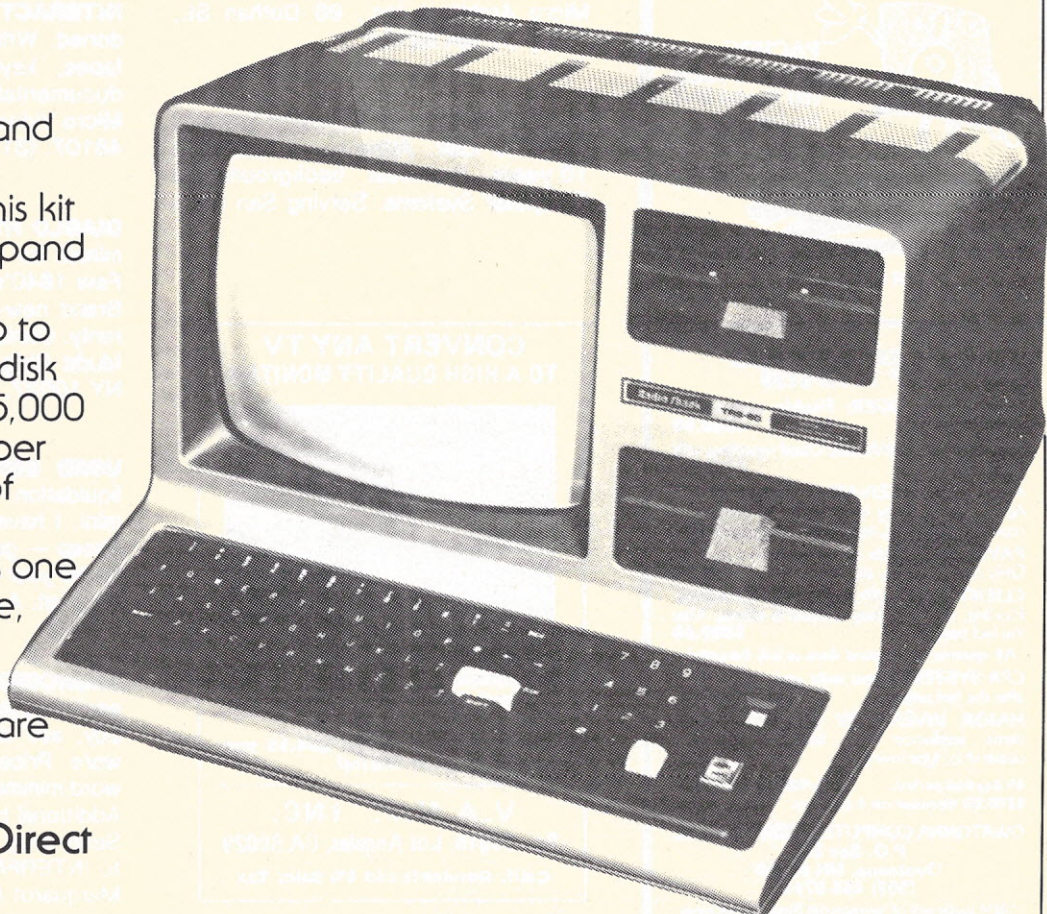
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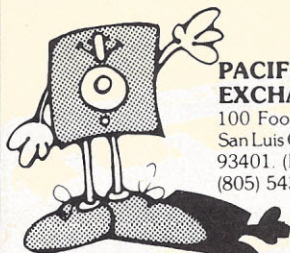
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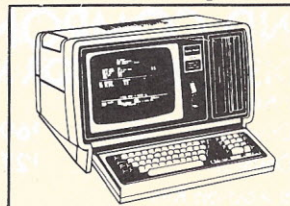


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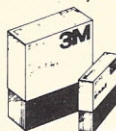
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Continued from page 6

portedly has spent close to \$25 million trying to perfect one. But it proved too sophisticated to implement: 35 communications centers spread across the country, each handling 4000 to 8000 accounts. The complexity of duplicating what an operator does is an impossibility except for the most skilled programmers. Exxon will no doubtedly get its system running simply because it has the resources to do it. If its ninth software rewrite doesn't work, the tenth will.

A doubting Smith

Smith researched the problems himself. He hired five systems engineers who worked for three months analyzing the experiment. He paid them \$60,000 to be told that the software would cost in the neighborhood of \$550,000 and take 14 to 15 man-years to create. This, they added, was a light estimate.

Smith disagreed, hired systems engineer Don Berry away from GTE Corp. (who pirated a few brilliant programmers from someone else) and together got the Answer Network system functioning in three years.

The automated system relieves the operator of the major hassles that plagued workers using the now-outmoded equipment. All calls coming in are processed by the computer on the requested number of rings. Calls are routed to the first available operator on a rotating basis.

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—MP

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